

INTRACOASTAL WATERWAY

ST. GEORGES SOUND TO THE
RIO GRANDE SECTION

LETTER FROM
THE SECRETARY OF WAR

TRANSMITTING

WITH A LETTER FROM THE CHIEF OF
ENGINEERS, REPORT ON SURVEY OF
THE ST. GEORGES SOUND, FLA., TO THE
RIO GRANDE SECTION OF THE PROPOSED
CONTINUOUS INLAND WATERWAY FROM
BOSTON, MASS., TO THE RIO GRANDE



JANUARY 17, 1914.—Referred to the Committee on Rivers and Harbors
and ordered to be printed, with illustration

WASHINGTON

1914

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LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, January 16, 1914.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

SIR: I have the honor to transmit herewith a letter from the Acting Chief of Engineers United States Army, dated 15th instant, together with copy of report by a special board of engineer officers, dated February 1, 1910, on survey of the St. Georges Sound, Fla., on the Rio Grande section of the proposed continuous inland waterway from Boston, Mass., to the Rio Grande, made in compliance with the provisions of the river and harbor act approved March 1909.

Very respectfully,

LINDLEY M. GARRISON,
Secretary of War.

INTRACOASTAL WATERWAY—ST. GEORGES SOUND TO THE RIO GRANDE SECTION.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, January 15, 1914.

From: The Chief of Engineers, United States Army.

To: The Secretary of War.

Subject: Intracoastal waterway—St. Georges Sound, Fla., to the Rio Grande.

1. There is submitted herewith, for transmission to Congress, report dated February 1, 1910, prepared by a special board of engineers, in accordance with provisions contained in the river and harbor act approved March 3, 1909, as follows:

SEC. 13. * * *

INTRACOASTAL WATERWAYS.

* * * * *

Survey for the construction of a continuous waterway, inland where practicable, along the Gulf of Mexico from Saint Georges Sound, Florida, to the Mississippi River at New Orleans, Louisiana, by way of Saint Andrews Bay, Choctawhatchee Bay, Pensacola Bay, and Perdido Bay, Florida; Mobile Bay, Alabama; Mississippi Sound, Alabama and Mississippi; Lake Borgne and Lake Pontchartrain, Louisiana, for the purpose of ascertaining the cost of a channel with a maximum depth of nine feet, or such lesser depths along any section or sections of the said waterway as may be found to be sufficient for commercial, naval, or military purposes. Such survey shall include an examination of all practicable routes, the preparation of plans and estimates of cost along the most available route, and a report upon the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same.

* * * * *

INLAND WATERWAY OF LOUISIANA AND TEXAS.

Survey for the construction of a continuous inland waterway from the Mississippi River to Bayou Teche; thence to Mermentau River; thence to Calcasieu River; thence to the Sabine River, Louisiana and Texas; thence to Galveston, Texas; thence to Brazos River, Texas; thence to Pass Cavallo; thence to Aransas Pass; thence to Point Isabel; and thence to the Rio Grande, for the purpose of ascertaining the cost of a channel with a maximum depth of nine feet, or such lesser depths along any section or sections of the said waterway as may be found to be sufficient for commercial, naval, or military purposes. Such survey shall include an examination of all practicable routes, the preparation of plans and estimates of cost along the most available route, and a report upon the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same: *Provided*, That whenever, in the making of a survey of any of the preceding waterways, field work shall indicate that the proposed improvement is clearly inadvisable no detailed survey or plans shall be made.

2. Owing to the extent of coast involved and to the differing conditions, natural and commercial, between the various parts of the route, it was found advisable to examine and report upon this stretch of inland waterway in 12 sections, divided as follows:

Section 1.—St. Georges Sound through Apalachicola Bay to Andrews Bay.

Section 2.—St. Andrews Bay to Choctawhatchee Bay.

Section 3.—Choctawhatchee Bay to Pensacola Bay.

Section 4.—Pensacola Bay to Mobile Bay.

Section 5.—Mobile Bay to Mississippi River.

Section 6.—Mississippi River to Sabine River:

(a) Mississippi River to Bayou Teche.

(b) Bayou Teche to Mermentau River.

(c) Mermentau River to Sabine River.

Section 7.—Sabine River to Galveston Bay.

Section 8.—Galveston Bay to Brazos River.

Section 9.—Brazos River to Pass Cavallo.

Section 10.—Pass Cavallo to Aransas Pass.

Section 11.—Aransas Pass to Brazos Santiago.

Section 12.—Brazos Santiago to Rio Grande.

3. The report of the special board gives a general description of the principal topographical features of each section, and a description of the most available routes for the proposed waterway in each section, and discusses also the probable commercial, naval, and military uses of such a waterway, and it reaches the conclusion that the uses are entirely insufficient to justify the large expenditure required for the construction and maintenance of a continuous waterway within the limits covered by the act; so that the entire project is not worth of being undertaken at the present time by the United States as a through waterway, although it is of the opinion that certain sections as specially described in its reports, are worthy of improvement as separate detached projects, to depths varying from 5 to 9 feet.

4. The report of this special board has been referred, as required by law, to the Board of Engineers for Rivers and Harbors, to whose report, herewith, dated April 2, 1912, attention is invited. The board concurs in some cases with the special board; its recommendations being in favor of the improvement of a lesser number of detached sections, and of the construction, in most cases, of a waterway of less depth than that recommended by the special board at these depths varying from 5 to 6 feet.

5. As the report of the special board indicated a cost in excess of what was considered advisable under present conditions by the Board of Engineers for Rivers and Harbors and by the Chief of Engineers, further reports were called for by the Chief of Engineers to show estimates of cost for a continuous waterway of 5 feet depth in all sections for which such estimates had not already been submitted; the new estimates being approximate and made from compilations and computations already on file in the engineer office. The cost per section of the waterway for the various depths of 5, 7, and 9 feet, respectively, as taken from these various reports, as follows:

Intracoastal waterway from St. Georges Sound, Fla., to the Rio Grande, Tex.

Sections.	Estimated cost for construction of channels of—				
Extent.	5 feet draft 40-65 feet width.	6 feet draft 100 feet width.	7 feet draft 75 feet width.	9 feet draft 100 feet width.	
St. Georges Sound to St. Andrews Bay...	(1)	.....	\$614,700	\$1,005,900
St. Andrews Bay to Choctawhatchee Bay.	² \$3,000,000	.....	3,321,250	4,311,750
Choctawhatchee Bay to Pensacola Bay...	(1)	(1)	³ 30,000	90,000	
Pensacola Bay to Mobile Bay.....	² 330,338	.....	432,435	717,240
Mobile Bay to Mississippi River.....	227,000	.....	312,015	529,650
Mississippi River to Bayou Teche.....	826,000	.....	1,655,500	2,242,900
Bayou Teche to Mermentau River.....	477,125	.....	1,869,250	2,810,950
Mermentau River to Sabine River.....	453,660	.....	1,188,150	2,085,735
Sabine River to Galveston Bay.....	475,000	.....	(6)	1,698,000
Galveston Bay to Brazos River.....	(4)	.....		623,700
Brazos River to Pass Cavallo.....	(5)	.....		1,314,420
Pass Cavallo to Aransas Pass.....	(5)	.....		3,246,905
Aransas Pass to Brazos Santiago.....	} 843,787	}		2,634,885	
Brazos Santiago to Rio Grande.....				476,855	
Total, sections 1-12.....	6,632,910	.....	15,723,300	23,788,890
Total, sections 3-12.....	3,632,910	.....	11,787,350	18,481,240

¹ Already provided.
² For 65-foot width.
³ About.
⁴ Already provided to 40-foot width.
⁵ Already provided to 65-foot width.
⁶ Roughly estimated at \$6,300,000, or two-thirds of 9-foot channel.

In these estimates the 5-foot channel is of 65 feet width; the 7-foot channel of 75 feet width, and the 9-foot channel of 100 feet width.

The said estimates make no allowance for cost of right of way, except for a few portions of sections 5 and 12, it being believed that in most instances the advantage to the localities concerned will be sufficient to cause the communities interested in the movement and benefited thereby to furnish the right of way required free of cost to the United States; and, furthermore, the estimates are based on the assumption (as recommended by both boards) that the actual routes selected to be adopted within the different sections shall at the time of actual construction work be subject to change or modification by the War Department according to such local conditions as may then exist. (See par. 32, Report of the Board of Engineers for Rivers and Harbors.)

In some cases the estimates of the 5-foot depth channel as given in the above table differ slightly from those given in the reports of the special board and of the Board of Engineers for Rivers and Harbors, or are omitted entirely, because of the fact that while the examinations and reports based thereon were in progress, Congress took up the question of improvement of some of the sections, and made appropriations for waterways of 5-foot depth or greater.

The above estimates show that it is possible to secure a continuous waterway of 9-foot depth from St. Georges Sound to the Rio Grande at the present time at a total cost of about \$24,000,000; and assuming that the cost of a 7-foot depth in the last six sections, as in the first six sections, will be about two-thirds of the cost of a 9-foot channel, they also indicate that a 7-foot depth continuous channel from St. Georges Sound to the Rio Grande can be secured at a cost of about \$8,000,000; while a 5-foot depth channel over the same distance can be secured for a little less than \$7,000,000, and a 5-foot depth

from Choctawhatchee Bay to the Rio Grande (sections 3 to 12, inclusive) can be secured for not exceeding \$3,633,000.

10. The special board recommends favorably at the present time a 9-foot depth waterway in part of section 5 and in all of section 6; a 7-foot depth waterway in sections 1, 4, the remainder of section 5, and all of section 6; a 6-foot depth waterway in section 3; a 5-foot depth waterway in sections 8, 9, and 10; and no waterway at all sections 2, 7, and 11 except so far as waterways already exist. The Board of Engineers for Rivers and Harbors recommends a 6-foot depth waterway in section 3; a 5-foot depth waterway in sections 6, 8, 9, and 10; and no improvement of existing waterways in sections 2, 4, 5, 7, 11, and 12. (In a report dated July 29, 1913, and which was published in River and Harbor Committee Doc. No. 7, 63d Congress 1st sess., the Board of Engineers for Rivers and Harbors recommends a 5-foot waterway in section 7.) The Chief of Engineers does not entirely agree with either board, but he concurs with the special board as to the line of route selected and with the Board of Engineers for Rivers and Harbors as to the lack of urgency for any depth at present in excess of 6 feet in section 3 and of 5 feet elsewhere. The Chief of Engineers believes also that the time has already come for a continuous waterway in sections 3 to 12, inclusive (6 feet deep in section 3 and 5 feet deep elsewhere), and for a waterway 5 feet deep in sections 1 and 2 whenever Congress shall have decided upon the construction of an intracoastal canal across the northern portion of Florida from the Atlantic to the Gulf.

11. The distance from St. Georges Sound to the Rio Grande is about 970 miles; the front covered by sections 1 and 2 being about 100 miles, that by sections 3 to 5, inclusive (from Choctawhatchee Bay to New Orleans), being about 270 miles, and by sections 6 to 12, inclusive (from New Orleans to the Rio Grande), being about 600 miles. Along this entire stretch from St. Georges Sound to the Rio Grande the land adjoining the coast front is, as a rule, low, and is, in the main, occupied either by almost continuous shallow inland sounds, or by low marsh or swampy ground interspersed with numerous creeks and small channels of shallow draft, through all of which the waterway construction will be comparatively simple and inexpensive, and the route once constructed may be maintained at reasonable cost. At present there are only about 12 places (about 100 miles in all) which can now be navigated by shallow-draft craft. Under past appropriations and provisions of Congress deep-draft harbors, allowing ocean boats to reach the mainland and existing railroad systems, now exist at Andrews Bay, Pensacola, Mobile, Gulfport, New Orleans, Sabine Pass (Port Arthur-Beaumont-Orange), Galveston, Brazos (18 feet deep), and Aransas Pass. But between these deep-draft harbors many rivers and small streams of Alabama, Mississippi, Louisiana, and Texas empty into the above-described sounds, which are unable to send their small-draft boats to the ocean ports of their own and adjoining sections. The Chief of Engineers believes that, as it is impracticable to improve each of the smaller rivers of the Gulf Coast to the extent of allowing to each a free access to ocean steamers, it will be more advantageous eventually to all these States to connect the lower ends of these streams by an inside coastal waterway which shall afford at an early date a 5-foot depth waterway connection to all the sections and especially to the nearest ocean port. In view of the rapid

Increasing production of the States above mentioned, and especially their increasing output of coal and petroleum, and their other natural resources, a continuous inland waterway of even 5 feet depth from Florida to the Rio Grande must be of great value in the early future, not only to the development of the existing ocean ports but also to the development of the inland and export commerce of all States concerned.

In connection with the omission at the present time (on account of the high cost) of section 2, it should be borne in mind that recent provisions for deep-water access to St. Andrews Bay will take care of the foreign export trade of the Apalachicola River basin of northern Georgia; and that the distance through the Gulf from St. Andrews Bay to Choctawhatchee Bay (section 2) is only about 60 miles of comparatively quiet water, so that the passage, when made in favorable weather, will require only daylight of a single day.

Since the commencement of the investigation of this inland waterway route under the act of March 3, 1909, the construction of a shallow-draft waterway has been provided by Congress through sections 1 and 3 by the act of June 25, 1910. A favorable report by the Chief of Engineers under date of August 19, 1913, has recommended a similar channel throughout section 7. Sections 8 and 10 have similar channels already in existence under past appropriations. The construction of a continuous channel throughout sections 3 to 7, inclusive, therefore, now requires further appropriations of Congress only in sections 4, 5, 6, and 7.

It is exceedingly desirable that wherever rights of way be secured for a 5-foot channel, the right of way should be made of sufficient width to allow of the future enlargement of the channel to 10 feet deep and 100 feet wide, should Congress at any time authorize such an enlargement.

I have, therefore, following the instructions of Congress as regards this section of the intracoastal waterway, to report that the improvement by the United States of the intracoastal route from St. Georges Sound, Fla., to the Rio Grande, Tex., is deemed advisable in order to give a 5-foot depth continuous inland waterway from Choctawhatchee Bay, Fla., to the Rio Grande, Tex. (6 feet in section 2 and 5 feet in sections 4 to 12, inclusive), following in general the route and methods recommended in the accompanying report of the special board, at a total estimated cost of \$3,632,910 for first construction, which amount, for economical work, should be appropriated in sums of at least \$800,000 per year.

EWD. BURR,
*Colonel, Corps of Engineers,
Acting Chief of Engineers.*

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS.

WAR DEPARTMENT,
THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, April 2, 1912.

REPORT: 1. Having considered the accompanying report of a special board on the survey for an inland waterway from St. Georges Sound to the Rio Grande, provided for by the act of March 3, 1909, the

Board of Engineers for Rivers and Harbors has the honor to submit its report thereon. In connection with its investigation of this subject, the board inspected portions of the route from Pensacola to New Orleans and thence to Bayou Vermilion and held public hearings at Pensacola, Mobile, and New Orleans, and at various times has given hearings at its office to interested parties on different portions of the route. In the report under review the entire distance is divided into a number of shorter sections, the points of division being suggested by natural conditions or commercial considerations.

SECTION 1.—ST. GEORGES SOUND THROUGH APALACHICOLA BAY AND ST. ANDREWS BAY.

2. There being already satisfactory light-draft navigation between St. Georges Sound and Apalachicola Bay, no improvement of this reach of the reach is considered. From Apalachicola Bay and River to St. Andrews Bay it is proposed to construct a connecting waterway via Lake Wimico, Searcy Creek, South Prong, Wetappo Creek, Bay, and St. Andrews Bay. Estimates are submitted as follows: Channel 7 feet by 75 feet, \$614,700; and 9 feet by 100 feet, \$1,005,000, maintenance, \$10,000 annually.

3. In considering the advisability of improving this reach special consideration is given to the commercial conditions of the Apalachicola River system, on which are handled about 120,000 tons of commerce per annum. The present outlet for this commerce is via Apalachicola Bay or St. Georges Sound, neither of which affords reliable facilities for vessels of the larger size, and as St. Andrews Bay has excellent natural harbor facilities a suitable connecting waterway would afford an outlet through this bay. As the deepest draft vessels plying the river draw approximately 6 feet, a channel depth of 7 feet is deemed sufficient, and this depth and a bottom width of 75 feet at an estimated cost of \$614,700 is recommended by the special board. Other possible routes were considered, but on account of excessive cost and for physical reasons were not deemed advisable.

4. In connection with this recommendation attention must be invited to the fact that the act of June 25, 1910, adopted a project for a connecting waterway 5 feet in depth and 65 feet in width between the Apalachicola River and St. Andrews Bay by the route now proposed by the special board, at an estimated cost of \$450,000. This project is now under construction.

5. As the upper Apalachicola River and its tributaries do not afford an available depth at ordinary low stages exceeding 5 feet, the Board of Engineers for Rivers and Harbors does not recognize the necessity or advisability of a greater depth for the connecting waterway at least for the present. The completion of this link will afford an outlet for the Apalachicola River system by way of St. Andrews Bay, and the dimensions are sufficient to determine the advantages of this route to the extent to which it will be used, and throw light upon the necessity of increased dimensions. The Board of Engineers for Rivers and Harbors therefore can not concur in recommending any improvement of this section at the present time beyond that already authorized and underway.

SECTION 2.—ST. ANDREWS BAY TO CHOCTAWHATCHEE BAY.

A survey of this section developed the existence of comparatively high land, attaining an elevation of 45 feet above Gulf level. The most practicable line was found to be West Bay Creek on leaving St. Andrews Bay and entering Choctawhatchee Bay in the vicinity of Point Washington. The character of the material indicated that the work would be difficult and expensive. The estimated cost of a channel 7 feet by 75 feet is \$3,321,250, and of a channel 9 feet by 100 feet \$4,311,750, the annual maintenance being placed at \$20,000. The special board states that neither as a purely local improvement nor as a section of the inland waterway would there be sufficient commerce to justify the improvement, and therefore it is not recommended. The Board of Engineers for Rivers and Harbors concurs in this view, believing that commensurate benefits would not result from the improvement of this reach. Subsequent to the submission of the original report, interested parties represented that a cheaper route might be obtained, and further investigation was made, but nothing was developed to lead to a change in the unfavorable recommendation for this section of the proposed waterway.

SECTION 3.—CHOCTAWHATCHEE BAY TO PENSACOLA BAY.

These two bays are connected by a natural waterway through which there is now light-draft navigation handling a considerable commerce. The estimates for improving this section are for a channel 7 feet by 100 feet, \$24,000, and 9 feet by 100 feet, \$90,000; maintenance negligible. The special board invites attention to a report on preliminary examination dated December 16, 1909, covering this reach, which its improvement to a depth of 6 feet at an estimated cost of \$20,000 was recommended. The special board concurs with the conclusions of that report, and recommends the appropriation of the sum involved. The project just referred to was adopted by the act of June 25, 1910, and the work is understood to be under way. This project is deemed sufficient, in the opinion of the Board of Engineers for Rivers and Harbors, to meet the present requirements of navigation at this locality, and therefore no additional improvement is recommended and no additional funds are required at this time.

SECTION 4.—PENSACOLA BAY TO MOBILE BAY.

The country between these bays is low, with a number of disconnected natural waterways, not at present affording a through navigable route. There are a number of possible routes over this section, the most economical and practicable being via Big Lagoon, Old River, Perdido Bay, Bay La Blanche, Wolf Bay, Portage Creek, thence across country to Bon Secour River, which it follows to Bon Secour Bay. The estimates for this section are, for a channel 7 feet by 75 feet, \$432,435; for a channel 9 feet by 100 feet, \$717,240. The special board recommends the lesser project as advisable. The principal argument in justification of the improvement appears to be that it would permit coal to be brought from the Warrior River system in barges drawing 6 feet to Pensacola Bay, which should result in

economy to the Government establishments in that vicinity, as well as to private consumers.

9. It does not seem to the Board of Engineers for Rivers and Harbors that there would be a very large general traffic between seaports of Mobile and Pensacola, as both have an established ocean trade. Moreover, the expected coal traffic on the Warrior River system has not yet developed and it would appear premature to undertake the construction of a waterway designed to take advantage of this traffic before its success is assured. The probability of a considerable commerce through this section of the proposed canal is, therefore, in the opinion of this board, not sufficiently encouraging to warrant the expenditure, and it therefore reports that in its opinion the improvement of the inland waterway between Pensacola and Mobile Bay is not advisable at this time.

SECTION 5.—MOBILE BAY TO MISSISSIPPI RIVER.

10. A cursory examination of this route indicates that at least the greater portion of the distance it will be impracticable to construct an inland waterway, as the land is high and there are no natural waterways which can be used to any material extent. It would be possible, however, to provide a partially sheltered route from Mobile Bay to Mississippi River by the use of Grants Pass or Pass aux Herons into Mississippi Sound, and from Mississippi Sound to the Mississippi via the Rigolets and Lake Ponchartrain and a canal to the Mississippi west of the city, or from Mississippi Sound via Lake Borgne via Bayou Dupre and Lake Borgne Canal, or a new one paralleling that canal and the Mississippi River for 11 miles to the city of New Orleans.

11. The special board states that the principal item of commerce likely to use such a waterway would be coal from the Alabama fields when the Warrior River improvement is completed, and as the improvement limits the draft of boats to 6 feet there would be no necessity for having a greater depth than 7 feet on the route from Mobile Bay to Mississippi. The estimates for a waterway of such depth are as follows: Via Mobile Bay, Pass aux Herons, Mississippi Sound, Rigolets, Lake Ponchartrain, \$456,005, maintenance \$10,000; via Mobile Bay, Pass aux Herons, Mississippi Sound, Lake Borgne via Dupre, Lake Borgne Canal, Mississippi River, including the purchase of the Lake Borgne Canal, approximately \$484,170, maintenance \$8,000; via same route with a new canal parallel to Lake Borgne Canal, \$312,015, maintenance \$8,000.

12. It will be seen that the latter is the cheapest route. The special board states that parties are negotiating for the purchase of the present Lake Borgne Canal property with the object of utilizing it for the transportation of Alabama coal. If this plan were carried out there would seem to be no reason why the United States should improve this section, and therefore no recommendation for improvement at the present time is made. It is stated that if discriminatory tolls are enforced or the property used in a manner detrimental to general commerce, the purchase of the present waterway or the construction of a new canal could then be taken up, and the method deemed most economical and advisable could be pursued. The Board

Engineers for Rivers and Harbors concurs in the findings of the special board as outlined above, and recommends for the present that further action be taken by the Federal Government.

SECTION 6.—MISSISSIPPI RIVER TO SABINE RIVER.

This reach is considered in three sections: (a) Mississippi River to Bayou Teche, (b) Bayou Teche to Mermentau River, and (c) Mermentau River to Sabine River.

(a) MISSISSIPPI RIVER TO BAYOU TECHE.

There are a number of possible routes over this section of the waterway. A number of lakes and bayous exist, and there are two privately owned canals covering a part of this reach. Estimates have been submitted in considerable detail for several of the most feasible routes, some of which involve the acquisition of the private canals. In the latter cases the estimate for the entire reach can be only approximately determined in view of the fact that no definite proposition for the sale of either of the private canals has been obtained, it being stated by the owners of these canals that if their purchase was effected they could be bought at their actual cost, the exact figure being given. The estimates are summarized as follows:

Route.	7 feet deep, 75 feet bottom width.	5 feet deep, 40 feet bottom width.
New route, through Lake Salvador.....	\$1,655,500	\$826,000
Harvey Canal route, through Lake Salvador.....	¹ 1,102,205	¹ 364,634
Company Canal route, through Lake Salvador.....	² 1,173,751	² 254,834
New route, skirting Lake Salvador.....	2,062,900	986,500
Harvey Canal route, skirting Lake Salvador.....	¹ 1,151,837	¹ 732,734
Company Canal route, skirting Lake Salvador.....	² 1,447,940	² 378,041

¹ Exclusive of cost of Harvey Canal property. ² Exclusive of cost of Company Canal property.

The special board recommends the construction of an inland waterway over this reach 7 feet deep and 75 feet bottom width, the route to follow either the Harvey or Company Canal if either of these properties or portions of them can be acquired at such price as would make the total cost less than that for new work, and in case this can be done that a new route be selected as indicated. In view of the cost it is recommended that the route through Lake Salvador be selected, and thence as described.

As stated within, a free waterway of adequate dimensions would be of great value to this section of country, where, owing to its low-lying lands and the great number of natural waterways, railroad construction would be very difficult, while water routes may be constructed at moderate cost. The practicability of this work has been proven through the construction of a number of private canals in this vicinity which are extensively used for general transportation purposes. In view of the fact that Congress has already adopted a depth of 7 feet for certain inland waterways through Louisiana and Texas, many of the bayous, lakes, and natural waterways with which a canal would connect have an available navigable depth of not

exceeding 5 feet, that the waterway would probably be used by ordinary river craft of not more than 4 to 5 feet draft, and that the cost of a canal 5 feet in depth would be very materially less than that of a 7 feet depth, the Board of Engineers for Rivers and Harbors believes that for the present at least a depth of 5 feet would satisfactorily serve the needs of navigation. It believes that interests involved are sufficient to justify the expenditure necessary to obtain a free waterway over this section 5 feet in depth, and it therefore reports that in its opinion it is advisable for the General Government to undertake the construction of a canal 5 feet deep and 40 feet wide at bottom, the route to follow such route as may be approved by the Secretary of War upon the recommendation of the Chief of Engineers, after the price at which the existing canals can be purchased and the questions of right of way have been determined. The total cost of the canal should not exceed approximately \$826,000, whether it follows one of the existing canals or a new route, and it may be considerably less. It is recommended that the first appropriation be \$300,000, and that subsequent appropriations be made so as to complete the work in three years.

(b) BAYOU TECHE TO MERMENTAU.

17. As stated within, Congress adopted a project under the act of March 2, 1907, for a waterway over this reach 5 feet in depth and 40 feet wide. The route proposed under this project was from Franklin Bayou via a dredged canal to Cote Blanche Bay, Vermilion Bay, Schooner Bayou, a dredged canal to White Lake, through White Lake and three small lakes to Grand Lake, which is an enlargement of the Mermentau River. This project was modified by the act of March 3, 1909, which authorized the location of the eastern terminus of the waterway at any suitable point on Bayou Teche that the Secretary of War might select, and again by the act of February 27, 1911, authorizing such changes in the location of said canal as may be considered desirable, provided a right of way is secured to the United States free of cost.

18. It is stated in the survey report that since the adoption of the project it has developed that the route through Cote Blanche Bay and Vermilion Bays is impracticable on account of the exposure and soft character of the bottom and the resulting tendency of the dredged channel to deteriorate rapidly. In view of this fact, a special board has considered a project for a route north of these bays. Between Bayou Teche and Vermilion Bay there are a number of possible routes described and estimated on, and may be briefly referred to, beginning with the northernmost, as New Iberia route, Jeanerette route, Franklin route, Hanson Canal route, and Centerville route. All of these routes come together at Bayou Carlin, from which point to the Mermentau they coincide, passing through the marsh on the north of Vermilion Bayou to Vermilion River, then through the marsh to Schooner Bayou, and to avoid the shallow waters of White Lake and Grand Lake, which have the same objections as Cote Blanche and Vermilion Bays, pass to the north of these waters to the Mermentau.

19. The special board regards the Hanson Canal route as the best between Bayou Teche and Bayou Carlin, after which, in the opinion given, it prefers the Centerville, Franklin, and Jeanerette routes.

A special board recommends a canal 7 feet deep with a bottom width of 75 feet from Bayou Teche to Bayou Carlin, the preference being given in the order named to the Hanson Canal, Centerville, Franklin, and Jeanerette routes, and from Bayou Carlin to the Mermentau by a route north of the lakes as described in the report. The estimated cost of this section of the waterway is:

Bayou Teche to Bayou Carlin.....	\$553,000
Bayou Carlin to Vermilion.....	461,250
Vermilion to Mermentau.....	855,000
Total.....	1,869,250

The estimated cost of maintenance is \$25,000 per year.

2. An estimate of \$477,175 is also submitted for a canal 5 feet deep and 40 feet bottom width, following the same route described above to Vermilion River, and thence by the route already adopted through White and Grand Lakes. By substituting a cut north of White Lake and Grand Lake for the route through these lakes, the cost becomes \$836,965. The estimated cost of maintenance is \$2,000 per year.

3. Congress has already adopted a 5-foot canal for this section of the route, and the work on the section from the Vermilion Bay (Booner Bayou) to the Mermentau River is practically completed. The Board of Engineers for Rivers and Harbors does not consider it advisable to adopt a 7-foot project at this time, believing that a 5-foot canal will be sufficient for the present and reasonably prospective demands of commerce. It concurs, however, with the special board in the opinion that the route should pass north of Cote Blanche and Vermilion Bays and follow the line recommended by the special board. No change is recommended for the present in the section from Vermilion Bay to the Mermentau River pending the results of experience in maintaining the channel constructed through White and Grand Lakes. The estimated cost of the canal as just outlined is \$477,175, and its construction by the United States is considered advisable.

(c) MERMENTAU RIVER TO SABINE RIVER.

2. A project for a waterway 5 feet deep and 40 feet bottom width, at an estimated cost of \$390,000, was adopted for this section by the act of June 25, 1910, which authorizes the Chief of Engineers, with the approval of the Secretary of War, to modify the plan proposed. But little work has been done under this project except in the way of surveys and investigations looking toward the location of the canal. The special board states that the best route for this waterway would start from the Mermentau River near its mouth, running through the lowlands in a westerly direction north of Lake Cadeau to a point near Sweet Lake, thence in a northwesterly direction through the marsh to Calcasieu River, from which point it runs in a southwesterly direction to Bayou Black and follows this to the Sabine. The board recommends the construction of a waterway over this section 7 feet deep and 75 feet bottom width at an estimated cost of \$1,188,150, annual maintenance \$10,000. Estimates are also submitted for a canal 5 feet deep and 40 feet wide by the same route in the sum of \$453,660, maintenance \$12,000.

23. The original estimate was based on a route through Lake Calcasieu. This is now considered impracticable on account of the deterioration to be expected in the channel, and the change to the proposed route outside the lake is deemed necessary. Since the publication of the special board's report it has been recommended by the district officer that the route between Calcasieu and Sabine be modified so as to pass on a more northerly line to the Sabine River. Local interests having agreed to pay the small difference in cost, this change has been authorized by the Secretary of War.

24. The Board of Engineers for Rivers and Harbors believes that for the present at least a depth of 5 feet is sufficient over this section as provided for or proposed for the balance of the route between the Mississippi River and the Sabine. It recommends that the proposed route north of Lake Calcasieu be adopted at the revised estimate of \$453,660.

SECTION 7.—SABINE RIVER TO GALVESTON BAY.

25. This route begins at the head of Lake Sabine, entering the lake following the present canal, which skirts the west shore of Lake Sabine to Taylors Bayou at Port Arthur, up Taylors Bayou to the Gulf of Mexico, which it generally follows to a point near the head of Lake Calcasieu, from which point it lies inland practically until it reaches Galveston Bay. The estimated cost of this section is \$1,698,000. There is but one small settlement between Port Arthur and Galveston Bay on this route, and the country is generally given over to grazing. The special board states that it can see no necessity at the present time for the improvement of this section, as its construction would be justified only as a connecting link for a through waterway which has not yet been provided, and therefore this section is not recommended.

26. Believing there would be little local traffic originating on this route, or any large amount of through commerce carried over it, the Board of Engineers for Rivers and Harbors concurs with the special board in the opinion that the improvement of this section is not advisable.

SECTION 8.—GALVESTON BAY TO BRAZOS RIVER (40 MILES)

27. Under an existing project a channel 5 feet deep and 40 feet wide has been excavated over this reach and the route of this channel is followed in the present investigation. An estimate is submitted for a channel 9 feet deep and 100 feet wide in the sum of \$625,000 for construction and \$60,000 annually for maintenance. There is very little commerce over this reach at present, although the waterway has been navigable for a number of years, and the present channel constructed under the existing project is adequate to meet the requirements of navigation for some time to come, and therefore the special board recommends no additional improvement on this reach. The Board of Engineers for Rivers and Harbors concurs in the recommendation of the special board.

SECTION 9.—BRAZOS RIVER TO PASS CAVALLO.

8. The act of June 25, 1910, adopted a project for the construction of a canal over this reach 5 feet deep and 40 feet wide at an estimated cost of \$400,000 and \$15,000 annually for maintenance. This work is now under construction. An estimate is given for increasing this waterway to a depth of 9 feet and a width of 100 feet at an estimated cost of \$1,314,420, with an annual maintenance charge of \$60,000. The country adjacent is very sparsely settled, the land rather poor and but little of it under cultivation. It is principally used for grazing purposes. The special board sees no necessity for the excavation of a channel of larger dimensions than that now under way, the principal object of which is to connect the sections of the land and waterway to the north and south of similar dimensions, with the possibility of a great tributary commerce. In the opinion of the Board of Engineers for Rivers and Harbors, the present project is ample to meet reasonable demands of commerce for at least a number of years to come, and it believes that such a project should be fully tested before any increase in dimensions is given. It therefore concurs with the special board in believing that at this time no additional improvement of this reach is advisable.

SECTION 10.—PASS CAVALLO TO ARANSAS PASS.

9. A project was adopted by the act of March 2, 1907, for the improvement of this reach by the construction of a channel 5 feet deep and 40 feet wide at an estimated cost of \$65,850, and this is practically completed. In connection with this work, a project for a much channel to the mouth of the Guadalupe River across the bay was adopted at an estimated cost of \$30,000, and was completed in 1909. A project was also adopted for the improvement of Guadalupe River to Victoria at an estimated cost of \$62,700, and although more has been expended on this work than originally estimated the project has not been completed. An estimate is presented for a channel 9 feet deep and 100 feet wide covering this reach, including the improvement of the Guadalupe River at an estimated cost of \$3,246,905.20; annual maintenance, \$100,000. There is very little commerce on this reach at present, and the special board recommends that this section be not considered worthy of further improvement at the present time. These views are in accord with those of the Board of Engineers for Rivers and Harbors, and therefore no additional improvement of this section is believed to be advisable.

SECTION 11.—ARANSAS PASS TO BRAZOS SANTIAGO.

30. A portion of this reach is covered by the existing project for the improvement of Turtle Cove channel between Aransas Pass and Corpus Christi, which as revised by the act of June 25, 1910, contemplates a channel 12 feet deep between Aransas Pass and Corpus Christi. The balance of the route is through Laguna Madre, which has a depth of from 1 to 8 feet, averaging apparently less than 3 feet. An estimate is presented for a channel 9 feet by 100 feet in the sum of \$2,634,885 with an annual maintenance charge of \$100,000. The country adjacent to this section is practically uninhabited south of Corpus Christi Bay, and there is practically no produce seeking the market by water route. In view of the great cost of this project as compared with probable benefits, the special board does not consider

this section as worthy of improvement. The Board of Engineers for Rivers and Harbors is in accord with these views, and therefore reports that in its opinion it is not advisable for the United States to undertake any improvement of this reach at the present time.

SECTION 12.—BRAZOS SANTIAGO TO RIO GRANDE.

31. This is a short section of canal, about 8 miles in length, extending to the Rio Grande from Point Isabel opposite the Brazos Santiago Inlet, in which there is generally a navigable depth of about 9 feet. The route is through Laguna Madre and partially through marshland. The country back of Point Isabel, in the vicinity of Brownsville and its tributary territory, is being rapidly developed and complained of for unreasonable freight rates. The locality desires some relief and the special board believes that a channel 9 feet deep and 100 feet wide from Point Isabel into the Rio Grande would be amply justified by the benefits to be derived. The estimated cost of this channel is \$476,855, the estimate for annual maintenance being \$20,000, and the special board recommends the adoption of this project. Through the committee the Board of Engineers for Rivers and Harbors made an examination of the locality traversed by this section of waterway, and also of the country tributary thereto in May, 1910. While the port of Texas back of this section has been developing rapidly, this board does not believe that the channel proposed, in connection with the questionable navigable capacity of the Rio Grande to Brownsville, the absence of a suitable channel from Point Isabel to the bar, and the uncertain 9-foot channel over the bar, would afford facilities sufficient to develop a commerce that would justify the large original cost of work and maintenance charges. It therefore states that in its opinion the construction of this section of the proposed intracoastal waterway by the United States is not now advisable.

32. The special board makes no allowance in its estimates for cost of right of way except between Lake Borgne and the Mississippi River and at the Rio Grande. It believes that in most cases the communities interested should furnish without cost to the United States the right of way required, but that if the construction of any section of the canal is authorized by Congress, the law should provide for condemnation of right of way where the same can not be had by voluntary donation. It also states that the routes specified are to be regarded as final selections of the best lines, and that when construction work is actually undertaken the route to be followed should be changed or modified if demanded by conditions. The Board of Engineers for Rivers and Harbors concurs with the views of the special board on this subject.

33. The law requires a consideration of the naval or military purposes of the canal, as well as its commercial uses. There appear to be no considerations of a naval or military nature that will modify the conclusions reached from a discussion of the commercial uses of the waterway.

For the board:

Very respectfully,

WM. T. ROSSELL,
*Colonel, Corps of Engineers,
Senior Member of the Board*

The CHIEF OF ENGINEERS, UNITED STATES ARMY.

SURVEY OF THE ST. GEORGES SOUND, FLA., TO THE RIO GRANDE SECTION OF THE PROPOSED INTRACOASTAL WATERWAY FROM BOSTON, MASS., TO THE RIO GRANDE.

REPORT OF A SPECIAL BOARD OF ENGINEERS.

NEW ORLEANS, LA., *February 1, 1910.*

GENERAL: The board appointed to make a survey for an inland waterway along the shore of the Gulf of Mexico from St. Georges Sound, Fla., to the Rio Grande has the honor to submit the following report upon the work intrusted to it.

The survey was directed by the following paragraphs of the river and harbor act of March 3, 1909:

Survey for the construction of a continuous waterway, inland where practicable, from the Gulf of Mexico from Saint Georges Sound, Florida, to the Mississippi River at New Orleans, Louisiana, by way of Saint Andrews Bay, Choctawhatchee Bay, Apicola Bay, and Perdido Bay, Florida; Mobile Bay, Alabama; Mississippi Sound, Alabama and Mississippi; Lake Borgne and Lake Pontchartrain, Louisiana, for the purpose of ascertaining the cost of a channel with a maximum depth of nine feet, or such lesser depths along any section or sections of the said waterway as may be found to be sufficient for commercial, naval, or military purposes. Such survey shall include an examination of all practicable routes, the preparation of plans and estimates of cost of the most available route, and a report upon the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same.

Survey for the construction of a continuous inland waterway from the Mississippi River to Bayou Teche; thence to Mermentau River; thence to Calcasieu River; thence to Sabine River, Louisiana and Texas; thence to Galveston, Texas; thence to Brazos River, Texas; thence to Pass Cavallo; thence to Aransas Pass; thence to Point Isabel; thence to the Rio Grande, for the purpose of ascertaining the cost of a channel with a maximum depth of nine feet, or such lesser depths along any section or sections of the waterway as may be found to be sufficient for commercial, naval, or military purposes. Such survey shall include an examination of all practicable routes, the preparation of plans and estimates of cost along the most available route, and a report upon the desirability of utilizing as a part of such waterway any existing public or private canal, or any part thereof, and the probable cost of acquiring the same: *Provided*, whenever, in the making of a survey of any of the preceding waterways, field work indicates that the proposed improvement is clearly inadvisable, no detailed survey or plans shall be made.

The board was constituted by the following order and was composed of the officers in charge of the river and harbor districts within which the waterway would be situated:

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 8, 1909.

SPECIAL ORDERS, NO. 10.

* * * * *
By authority of the Secretary of War, a board of officers of the Corps of Engineers, consisting of Lieut. Col. Lansing H. Beach, Maj. Henry Jervey, Capt. John C. Oakes, Lt. Harley B. Ferguson, Capt. Albert E. Waldron, is hereby appointed to make a survey for a continuous inland waterway along the Gulf of Mexico from St. Georges Sound, Fla., to New Orleans, La., thence from the Mississippi River to the Rio Grande River, and submit report thereon, as prescribed in the river and harbor act of March 3, 1909.

That board will meet at New Orleans, La., upon the call of the senior member, not later than April 1, 1909, and is authorized to visit such localities as it may deem necessary for the proper performance of its duties.

Upon the completion of the duties assigned them, the members of the board will return to their proper stations.

The travel directed is necessary in the military service.

By command of the Chief of Engineers.

FREDERIC V. ABBOT,
Lieut. Col., Corps of Engineers.

The surveys, examinations, and investigations were conducted by the individual officers within the limits of their respective districts, the maps and estimates prepared under their direction, and the data thus obtained was laid before the board, which, in cases, supplemented this information by a personal examination.

The route of the waterway contemplated is divided sometimes by natural conditions, sometimes by commercial considerations, into various sections which differ so much from each other in natural features and commercial possibilities, and at parts in both combined that it was regarded advisable to describe and consider these portions separately before attempting to take up the question of the waterway as an entirety.

That portion of the coast from St. Georges Sound to Pensacola Bay lies in the Montgomery, Ala., river and harbor district, under charge of Capt. Harley B. Ferguson, Corps of Engineers. It is divided into three sections. Beginning at the east they are: From St. Georges Sound to St. Andrews Bay; from St. Andrews Bay to Choctawhatchee Bay; from Choctawhatchee Bay to Pensacola Bay.

St. Georges Sound to St. Andrews Bay.—St. Georges Sound and Apalachicola Bay, to the west of it, form one body of water approximately 40 miles long and from 4 to 8 miles wide, the dividing line between the two being merely a small reef with 4 to 5 feet of water over it. The depth in the eastern part is in excess of 9 feet, but in Apalachicola Bay, which shows a tendency to shoal as a result of the silt brought into it by the Apalachicola River, there are many places less than that figure, and that depth can not be considered as available without dredging. St. Georges Sound is closed at its eastern end, and there is no tendency for freight to move in that direction.

St. Andrews Bay, at the western extremity of this section, is a very irregularly shaped body of water with ample depth for seagoing vessels and forming one of the best natural harbors on the Gulf coast. Owing to the fact that it has no rivers emptying into it, it receives no silt and shows no tendency to diminish in depth, as do many of the other bays. It is on this account that freight brought to the seaboard by way of the Apalachicola River seems to be seeking an outlet at this place. The country between the two bays is partly swamp and partly timber land, thinly wooded; it is comparatively low, and offers a route with no greater elevation than 7 feet throughout its entire line.

The route regarded as best by the board between the two bays leaves the Apalachicola River at a point about 5 miles above its mouth and is 31 miles in length, 16 miles being in Lake Wimico, Searcy Creek, and Watappo Creek, which will require more or less dredging; the remaining 15 miles is by canal. Where these natural waterways are less than 75 feet wide and 7 feet deep they are classed as canals. Watappo Creek empties into the eastern end of East Bay, a branch of St. Andrews Bay, which affords a depth greater than 9 feet throughout its length of 21 miles by the channel to a point opposite the point connecting with the Gulf of Mexico.

The estimated cost of a waterway from the Apalachicola River to St. Andrews Bay by the route named is as follows, the figures being

for a depth of 9 feet and width of 100 feet and also for a smaller
7 feet in depth and 75 feet in width:

George's Sound to St. Andrews Bay section—Apalachicola Bay, Apalachicola River,
Lake Wimico, Searcy Creek, South Prong Watappo Creek, East Bay, St. Andrews
Bay route.

Dimensions.	Excavation.	Unit price.	Total cost.
Feet.	Cubic yards.		
100.....	6,706,000	\$0.15	\$1,005,900
75.....	4,098,000	.15	614,700

Annual maintenance, \$10,000.

In determining the advisability of constructing this section of
waterway, the conditions prevailing upon the Apalachicola River
system must be considered. The Apalachicola River has a navigable
depth of 6 feet from its mouth to the junction of the Flint and Chat-
tahoochee Rivers. There is a navigable depth of 4 feet in the Flint
River to Bainbridge, a distance of 78 miles, and in the Chattahoochee
River to Columbus, 163 miles.

The commerce of the Apalachicola River system, which tends to
seek an outlet at the Gulf of Mexico, amounts to about 120,000 tons
per year. Apalachicola Bay, with its shallow depth and difficulty of
maintenance, does not afford a harbor for vessels of the larger sizes,
and is considered economical in ocean or coastwise commerce, and the
preference is for the utilization of St. Andrews Bay as an outlet.

Congress has ordered a preliminary examination and survey for a
harbor at this point, and the recommendation has been made that a
channel 22 feet deep be provided through the pass into the bay at a
cost of \$200,000. If the Apalachicola River were connected with
St. Andrews Bay, the boats which carry the river commerce could
load at the same wharf with or alongside ocean-going vessels of 20-foot
draft and thus permit a transfer of freight in the most economical
manner. As the deepest draft vessels plying on the river draw
approximately 6 feet, it is considered that a channel of dimensions
sufficient to enable such boats to navigate the waterway at all stages
of tide will be ample to satisfy present requirements, and that such
a channel need not be greater than 7 feet deep and 75 feet wide on the
bottom.

This section, considered as part of the through inland waterway or
considered alone, is, in the opinion of the board, worthy of improve-
ment to the extent above mentioned, and it is recommended that the
sum of \$614,700 be appropriated for such improvement.

Other route considered.—A survey was also made of another route
leaving the Apalachicola River at Dalkeith, about 40 miles above
the mouth of the river. For this distance 9 feet can be maintained
in the river. This route runs practically due west to Watappo
Creek, where, at the mouth of South Prong, it joins the Lake Wimico
route, above recommended. As part of the inland waterway, the
Dalkeith route is about 10 miles longer than the Lake Wimico route.
A channel connecting this river system with St. Andrews Bay,

the Lake Wimico route is 46 miles longer than the Dalkeith route. The estimated cost of a canal by the Dalkeith route is as follows:

St. Georges Sound to St. Andrews Bay section—Apalachicola River, Dalkeith, Rin Bluff, Watappo Creek route.

Depth and width (feet).	Excavation.			Lock.				Gr to
	Cubic yards.	Unit price.	Total.	Dimensions (feet).	Unit price.			
					Con- crete, per cubic yard.	Steel, per pound.	Total.	
1.9 by 100.....	10,938,000	\$0.20	\$2,187,600	324 by 56 by 9...	\$6.00	\$0.05	\$190,000	\$2,377,600
2.7 by 75.....	7,863,000	- .20	1,572,600	150 by 50 by 7...	6.00	.05	140,000	1,712,600

Annual maintenance, \$10,000.

No estimate was prepared for a route running through the west arm of Apalachicola Bay, known as St. Vincent Sound, into St. Josephs Bay, and thence through the mainland into St. Andrews Bay, the route being regarded as impracticable for the reason that it would be both difficult and expensive to maintain a channel through St. Vincent Sound, the exposure in St. Josephs Bay would be such that steam craft would at times be unable to navigate it, and the distance would be too greatly increased for all vessels entering or leaving Apalachicola River.

St. Andrews Bay to Choctawhatchee Bay.—The west arm of St. Andrews Bay, known as West Bay, offers 13 miles of natural waterway having a depth of 9 feet or more. From this point to Choctawhatchee Bay, a distance of 18 miles in a straight line, the country is comparatively high for the coast of the Gulf of Mexico, the land rising in places to an elevation of 45 feet above the Gulf level. The line of least elevation is found by following West Bay Creek, leaving St. Andrews Bay and entering Choctawhatchee Bay in the vicinity of Point Washington. The land is generally thinly wooded and is uninhabited. The materials through which a canal would have to be excavated are clay and sand of such character that dredging could be performed only with difficulty, and the expense of this section would be great. Choctawhatchee Bay, at the western extremity of this section, is about 30 miles long with a width varying from 4 to 6 miles; it has throughout its extent a depth of more than 9 feet and in the western portion depths of 36 feet and over. There are no towns situated upon it.

St. Andrews Bay to Choctawhatchee Bay section—St. Andrews Bay, West Bay to Choctawhatchee Bay route.

Depth and width (feet).	Excavation.	Unit price.	Total cost.
	Cubic yards.		
9 by 100.....	17,247,000	\$0.25	\$4,311,750
7 by 75.....	13,289,000	.25	3,322,250

Annual maintenance, \$20,000.

so far as can be seen at present, considering this section either as purely local improvement or as a section of the inland waterway, there would not be sufficient commerce to justify at this time the proposed improvement, and the board therefore can not recommend that any appropriation be made for this section.

Choctawhatchee Bay to Pensacola Bay.—Choctawhatchee Bay is connected to Pensacola Bay by an existing natural waterway, parallel to and about half a mile from the Gulf shore; the eastern portion, 11 miles in length, termed The Narrows, being from one-fourth to one-half a mile wide, with a narrow winding channel obstructed in several places by bars, with 5 feet or less of water over them. The western portion, known as Santa Rosa Sound, is about 26 miles long and from 5 to 10 miles wide. It has a depth of more than 9 feet throughout its length. From the western end of Santa Rosa Sound to the wharves of Pensacola is 6 miles. The estimated cost of deepening this natural waterway is comparatively small and is as follows for the depths shown:

Choctawhatchee Bay to Pensacola Bay section—Choctawhatchee Bay, The Narrows, Santa Rosa Sound, Pensacola Bay route.

Depth and width (feet).	Excavation.	Unit price.	Total cost.
	<i>Cubic yards.</i>		
100.....	450,000	\$0.20	\$90,000
100.....	120,000	.20	24,000

Maintenance negligible if the channel is much used.

The commerce originating on Choctawhatchee Bay consists mainly of lumber and pine products and is estimated to amount to approximately 42,000,000 feet of lumber, 14,000 barrels of turpentine, and 49,000 barrels of rosin, worth more than \$1,000,000. This tends to seek Pensacola for an outlet, and could be brought to market much more economically were there a slight improvement in the waterway between the two bays. The commerce on the Choctawhatchee River in 1908 was valued at \$2,211,000. The channel at its mouth in the bay has been dredged to a depth of 6 feet and a bulkhead constructed to maintain it. Some of this commerce would undoubtedly seek salt water at Pensacola were a satisfactory channel provided between the two bays.

A report of preliminary examination and survey has been rendered on this improvement by the district officer, dated December 16, 1909, and the locality was reported worthy of improvement to the extent of providing a channel 6 feet deep, which is considered sufficient for the present needs of commerce. The board coincides with this opinion and therefore recommends that the sum of \$24,000 be appropriated for a channel of this depth in accordance with the above-mentioned report.

Pensacola Bay to Mississippi River.—That portion of the Gulf of Mexico coast from Pensacola Bay to Pearl River which empties into the easterly end of Lake Borgne is in the Mobile (Ala.) River and Harbor district under the charge of Maj. Henry Jervey, Corps of Engineers. The Engineer Office at New Orleans, La., under Lieut. Col. Lansing H. Beach, Corps of Engineers, has charge of all work

between Pearl River and the Mississippi. The surveys, investigations, and estimates were made by these officers in their respective portions of the route. It is divided by Mobile Bay into two sections from Pensacola Bay to Mobile Bay, from Mobile Bay to the Mississippi River.

From Pensacola Bay to Mobile Bay.—The distance from Pensacola Bay to Bon Secours Bay, as the southeasterly arm of Mobile Bay named, is almost exactly 30 miles in a straight line. The count between the two bays is low near the coast and is cut up by various bodies of water only partly connected with each other. Many different routes could be located through these stretches of water differing from each other according as one or the other natural body of water is selected for the following link.

The route which appears the most practicable and is the most economical in final cost is that which enters Big Lagoon, after dredging through shoal water for about 1 mile, and from the west end of that bay passes by canal through land about 4 feet above Gulf level to Old River, which is that part of Perdido Bay nearest the Gulf of Mexico. The channel follows natural deep water in this bay with the exception of an occasional shoal, and passing through the lower end enters Bay La Lanche, which it leaves at Portage Creek on the westerly side. Shoal water is reached approximately 1 mile in advance of the mouth of Portage Creek. The line follows this creek for approximately 2 miles and then cuts across country to Bon Secours River, which it follows to Bon Secours Bay, the mouth of this river being about 36 miles from Mobile. The eastern end of Bon Secours Bay is quite shallow, a depth of 9 feet being at a distance of approximately $3\frac{1}{2}$ miles from shore, 7 feet being at a distance of 1 mile. For either depth the channel would have to be excavated in the open bay. From the end of the channel, ample depth exists across Mobile Bay to the City of Mobile. In passing from Bay La Lanche to Bon Secours River the channel will have to be cut through land having an approximate elevation of 8 feet, composed of clay and sand partially covered with timber, the stumps of which would make dredging somewhat difficult.

The estimated cost of 9 and 7 foot channels are as follows:

Pensacola Bay to Mobile Bay section—Pensacola Bay, Big Lagoon, Old River, Perdido Bay, La Lanche Bay, Portage Creek, Bon Secours River, Bon Secours Bay, Mobile Bay route.

Dimensions (feet).	Excavation.	Unit price.	Total cost.
	<i>Cubic yards.</i>		
9 by 100.....	4,281,600	\$0.15	\$642,240
7 by 75.....	2,382,900	.15	357,435

Three drawbridges, \$75,000.

The board is unable to see, at the present time, any necessity for a 9-foot canal between Pensacola and Mobile Bays. At Pensacola, however, there is considerable Government work being carried on, and at Government military posts at Forts McRee, Pickens, Barrancas, and the United States navy yard at Warrington. A large quantity of coal is used by these various Government organizations.

well as by the inhabitants of the country adjacent to Pensacola and by steamships entering Pensacola Harbor. The Black River entering Mobile Bay is under improvement to provide foot navigation, and at the present time some coal comes out of the river in barges drawing approximately 6 feet. If this section of the canal were opened with sufficient depth and width to allow passage of these barges from Mobile Bay to Pensacola, a large saving to the Government in the cost of coal would be obtained and to the people in general. This canal might be used for the transportation of various other commodities, particularly in the coming of loads of ships at either Pensacola or Mobile, where a partial saving was to be obtained at each of these two ports, and the cost of moving the ship would be greater than the cost of moving the partial loads by barges or where time would be saved by loading from both wharf and wharf simultaneously. The board believes, therefore, that this section is worthy of improvement to the extent of providing a channel 7 feet deep and 75 feet wide on bottom at an estimated cost of \$432,435, and so recommends.

In addition to the route recommended by the board, several other routes were considered as shown on map accompanying this report, but as all are more expensive in construction except one and possess no advantages over that selected, they are not named in detail. The route which would be cheaper in cost of construction alone is obtained by bending to the south of the proposed line where it enters the Secours River, and passing through Oyster Bay, thence down the Southern Branch of Bon Secours River, reuniting with the proposed line at the junction of the two branches of the Bon Secours River; about \$35,000 could be saved in the first cost of construction. The objection to this deflection is that Oyster Bay is shallow, having a depth of only 2 or 3 feet, and the bottom of the entire bay is used for oyster cultivation and is considered very valuable property by the farmers. This route would require more time for a vessel to traverse on account of the greater number of bends, it being considerably more crooked than the line proposed, and it is believed that this, as well as the damages to the oyster industry in this bay which would result from dredging operations render it inadvisable to locate the channel along this line.

The country in the neighborhood of this section of canal is sparsely settled, but the land gives promise of developing into excellent truck farms if given means of shipping products to a market.

Mobile Bay to Mississippi River.—The conditions in this section are such that a waterway back from the coast becomes impracticable, and there is no other route available at reasonable cost than that through the comparatively open water of Mississippi Sound. Throughout the entire length of this body of water, about 84 miles, the coast is dotted with towns and villages, and through them all runs the Louisville & Nashville Railroad, parallel to the shore and as close to the water as questions of right of way through the towns and economy of construction would permit. It is impossible to obtain any line of waterway between the railroad and the shore. Although there are waterways extending from the Gulf back of the railroad, they do not even approach within such distance of each other that canals could be cut between them without an enormous outlay, on account of the generally high elevation of the land. The excessive amount

of excavation which would be involved is shown by the following list of elevations at the different points along the line, which show the approximate elevation of points near the Louisville & Nashville Railroad track and their distance from Mobile:

Location.	Distance from Mobile.	Elevat above level.
	<i>Miles.</i>	<i>Feet</i>
St. Elmo Station.....	19	
Grand Bay.....	25	
Scranton.....	40	
Ocean Springs.....	57	
East end Biloxi Bay Bridge.....	58	
West end Biloxi Bay Bridge.....	59	
Beauvoir Station.....	66	
79 feet north of Louisville & Nashville track.....	76	
26 feet north of Louisville & Nashville track.....	79	
30 feet north of Louisville & Nashville track.....	83	
Henderson Point.....	86	
Bay St. Louis.....	89	
Waveland.....	93	
Toulme Station.....	96	
East Pearl River.....	103	

A route through the land from Mobile Bay to Lake Borgne at western end of Mississippi Sound was, therefore, not considered by the board, and no estimates were prepared. The only practical route for this section is through Mississippi Sound for a distance 84 miles from Mobile Bay or 117 miles from Mobile. To avoid compelling vessels to go out into the Gulf of Mexico and also to save them a detour of 20 miles it is proposed to cut a channel across the shoal at Pass Aux Herons, about half a mile south of Grants Pass where only a comparatively small amount of material will have to be removed.

A natural depth of 9 feet or more exists at present throughout the whole length of the sound to Lake Borgne. The line from Grants Pass through the Mississippi Sound is much exposed to wind and weather. It is, however, protected on the south to a certain extent by a line of islands, but there will undoubtedly be numerous difficulties during the year when light-draft craft will have difficulty in navigating this section. These islands, however, are in most cases heavily timbered and will afford protection in case of storm and, to a certain extent, safe anchorage.

There are also several harbors at intervals on the north shore of this sound affording ample refuge for small craft during sudden rough weather.

The cost of cutting a channel through Pass Aux Herons is comparatively slight, there being, it is estimated, only about 130,000 cubic yards of material to be removed, which, at \$0.25 per cubic yard would amount to \$32,600 for a 9-foot channel.

Five other routes between Mobile Bay and Mississippi Sound were considered by the board, but not regarded as equal to that through Pass Aux Herons. One of these was by way of Fowl River.

A canal claimed as private property exists through Grants Pass, and it would cost about \$6,000 less for dredging to construct a canal 9 feet in depth on this line than through Pass Aux Herons, but all efforts have been unsuccessful in obtaining a statement from the parties in possession as to the sum for which they would relinquish their claim.

ownership. It is believed that they would demand considerably more than \$6,000 and that the Pass Aux Herons route is, therefore, a cheaper line.

From the eastern end of Lake Borgne two widely separated routes to the Mississippi River were considered by the board. One passes through that lake for a distance of 24 miles and enters the Mississippi 14 miles below Canal Street in New Orleans by way of Bayou Dupre, but 4 miles long, and the Lake Borgne Canal, almost 3 miles in length. The canal is connected with the Mississippi River by a lock having a chamber 40 feet wide and 280 feet long, with an original depth of 7 feet. The canal itself is supposed to have this depth and a least width of 80 feet, but has probably been allowed to shoal, for it is understood that at the time of the recent survey of this route there were places which did not have more than 6 feet of water, and one place was found with only 4 feet. The miter sills have also, it is stated, been raised since the lock was first built and have now a depth over them of only 5.56 feet at mean low tide. The canal is crossed by a single-track railroad bridge having a clear opening of 40 feet.

The canal is owned by the Lake Borgne Canal Co., but has been leased by them until 1928 with privilege of purchase by the lessees. Inquiries of the lessees as to the price at which the property would be transferred to the Government have remained unanswered, and it has been impossible also to obtain from them any information concerning the width of the right of way or its status, whether held in fee simple or not, nor, in fact, to learn anything except such facts as could be ascertained by personal examination at the site. The preliminary report of the Inland Waterways Commission (S. Doc. No. 100, 60th Cong., 1st sess.) states, on page 308, that there were 3,250 shares of stock of a par value of \$100 each outstanding on March 30, 1906. It is not believed from all that can be learned that any have been retired since that date.

The western end of Lake Borgne is quite shallow, and it will be necessary to dredge a channel for more than 6 miles in order to carry a depth of 9 feet to the mouth of Bayou Dupre.

The estimated cost of constructing and obtaining a 9-foot channel from Lake Borgne to the Mississippi is as follows:

Excavation, lake, 404,000 cubic yards, at \$0.15.....	\$60,600
Excavation, canal, 1,130,000 cubic yards, at \$0.15.....	169,500
Construction of lock.....	60,000
Contingencies, 10 per cent.....	29,000
Lease of canal (uncertain).....	325,000
Total.....	644,100

Maintenance probably \$20,000.

The other route, from the eastern end of Lake Borgne to the Mississippi, is by way of The Rigolets to Lake Pontchartrain and thence by canal into the river above the city of New Orleans. A depth of 40 feet and more prevails through The Rigolets, but considerable dredging would have to be done in the eastern end of Lake Pontchartrain to obtain a 9-foot channel. The land between the lake and the river is generally wooded and flat, having an elevation of about 2 feet at the edge of the lake and about 9 feet at the river. A lock will be necessary at the point where the canal joins the river. Three rail-

roads, the Yazoo & Mississippi Valley Railroad, the Illinois Central and the Louisiana Railway & Navigation Co., cross the line of canal, each by a single track, and it would be necessary to build the movable bridges unless the first two roads, which are under the same control at the present time, would be willing to use one double-track bridge instead of two separate structures with a single track each. Three highways also cross the line of the canal and it would probably be necessary to place movable bridges at those points. The canal should be cut so as to enter the Mississippi River at some point above the levee which the city of New Orleans has built to protect itself against overflow during high water. An examination at the present time indicates that a route taking advantage of the depression Bayou Labarre would probably be an economical location, but much more depends upon selecting a point for entrance to the Mississippi where the bank is making, and upon avoiding any place with a caving bank, that the location of the Lake Pontchartrain end of the canal becomes a secondary matter. Between the railroads and the lake the land is practically all swamp and quite a variation of location could be made without affecting the cost.

From the eastern end of Lake Borgne to the point where the canal would probably leave Lake Pontchartrain is approximately 45 miles. The canal will be about $4\frac{1}{2}$ miles in length and its river end will be about 10 miles above the Canal Street landing at New Orleans.

The estimated cost of a 9-foot channel by this route is as follows:

Dredging in Lake Pontchartrain, 230,000 cubic yards, at \$0.15.....	\$49
Canal excavation, 1,181,000 cubic yards, at \$0.15.....	177
Three railroad bridges, at \$40,000	120
Three highway bridges, at \$5,000.....	15
Lock.....	120
Contingencies about 10 per cent.....	48
Total.....	529

Maintenance probably \$20,000 per annum.

It is somewhat doubtful if a waterway 9 feet in depth is necessary between Mobile and New Orleans. As both cities have their commerce with the foreign commerce, it is not probable that there will be any freight passing from one port to the other for shipment abroad or for distribution to the interior. It is expected, however, that as soon as the rivers leading to the Alabama coal fields are sufficiently improved to permit coal to be brought to Mobile by water, that that city will become an important coal-distributing point. A waterway of 9 feet would allow the use of larger tugs than could be used upon a 7-foot channel, which would be an important advantage in the semiopen water of the Mississippi Sound, but as the barges used to bring coal to the seaboard will be limited to a draft of 6 feet by river conditions, it is believed that a 7-foot waterway will answer all demands until other features may develop.

The estimated cost of a 7-foot waterway by the two routes is as follows:

Mobile Bay to Mississippi River section—Mobile Bay, Pass Aux Herons, Mississippi Sound, The Rigolets, Lake Pontchartrain, Mississippi River route.

Channel through Pass Aux Herons, 88,000 cubic yards, at \$0.25.....	\$22, 000
Dredging in Lake Pontchartrain, 52,000 cubic yards, at \$0.15.....	7, 800
Canal excavation, 865,000 cubic yards, at \$0.15.....	129, 750
Railroad bridges, at \$40,000.....	120, 000
Highway bridges, at \$5,000.....	15, 000
Contingencies about 10 per cent.....	120, 000
	41, 455
Total.....	456, 005
Annual maintenance, \$10,000.	

Mobile Bay, Pass Aux Herons, Mississippi Sound, Lake Borgne, Bayou Dupre, Lake Borgne Canal, Mississippi River route, with purchase of Lake Borgne Canal.

Channel through Pass Aux Herons.....	\$22, 000
Dredging in Lake Borgne, 41,000 cubic yards, at \$0.15.....	6, 150
Canal excavation, 377,000 cubic yards, at \$0.15.....	56, 550
Construction of lock.....	60, 000
Contingencies, about 10 per cent.....	14, 470
Purchase of canal (uncertain).....	325, 000
Total.....	484, 170
Annual maintenance, \$8,000.	

Same route, with construction of a new canal parallel to present Lake Borgne Canal.

Channel through Pass Aux Herons.....	\$22, 000
Dredging in Lake Borgne.....	6, 150
Canal excavation, 650,000 cubic yards, at \$0.15.....	97, 500
Combined highway and railroad bridge.....	30, 000
Lock.....	120, 000
Right of way.....	8, 000
Contingencies, about 10 per cent.....	28, 365
Total.....	312, 015
Annual maintenance, \$8,000.	

From these estimates the route through Lake Borgne appears cheaper than that through Lake Pontchartrain and has the further advantage of being 21 miles shorter from Mobile. It has the disadvantage of entering the Mississippi River below New Orleans and requiring all freight to be carried upstream for an average distance of 11 miles. There is an important commerce between the rivers and bayous of the north shore of Lake Pontchartrain and New Orleans. It is impossible to state the full extent and amount of this trade, because a considerable portion of it occurs upon streams which are not under improvement by the United States and for which no commercial statistics are available; but that upon the three most important rivers amounts to 330,000 tons each year, valued at \$2,790,000. A canal above the city of New Orleans would give a route from these places to the water front of the city shorter by an average distance of 11 miles than that through Lake Borgne. This commerce exists to-day and is increasing, while that through Mississippi Sound has yet to be developed. The Lake Pontchartrain route would be more exposed than that through Lake Borgne, and there would probably be considerable opposition on the part of the railroads to having drawbridges installed on their lines.

After taking the relative advantages and disadvantages into consideration, the board believes that the Lake Borgne route will best serve all purposes. It is understood that parties are now negotiating for the purchase of the Lake Borgne Canal property, with the object of utilizing it as a means of bringing Alabama coal more cheaply into the Mississippi. Should the waterway and lock be placed in good condition, there would seem to be no reason why the United States should acquire the property unless it be used in a manner detrimental to general commerce by either excessive or discriminating tolls. Until such methods of operation are employed or the physical condition becomes such that it can not properly accommodate the commerce seeking the route, the acquisition of the canal by the United States is regarded by the board as neither necessary nor advisable. The purchase of the present waterway or the construction of a new canal would then be decided by the relative cost of the two methods. The property can not be remunerative or valuable unless kept in good operating condition; its history shows this. In 1873 it was sold in execution of a judgment against the company; in 1881 it was sold to the State for taxes, and again sold for taxes in 1885, and in 1895 it was sold at sheriff's sale in execution of a judgment.

Mississippi River to Sabine River.—This portion of the waterway is in the New Orleans, La., river and harbor district under charge of Lieut. Col. Lansing H. Beach, Corp of Engineers. It lies within a region of alluvial deposit by the Mississippi River, and consists of vast stretches of marsh, containing numerous areas of cypress swamps varying in size from a few acres to miles in extent, and a many lakes from a quarter of a mile to 30 miles in length. It is intersected by a large number of waterways, termed bayous, having a general north and south direction, with a well-defined current toward the Gulf of Mexico after a pronounced rainfall, but for the larger part of the time with only a very sluggish current, which is often reversed at high tide. As it will be necessary to name some of the more important of these bayous and lakes in describing the separate sections, they are not included here. The highest land is found immediately adjacent to the bayous; the larger the bayou the higher its banks, as a rule. The depth of water in the bayous is nearly always sufficient for navigation by river craft, and not infrequently is as great as 20 to 30 feet for miles in succession. The lakes, on the contrary, are generally shallow, those 10 to 15 miles across having depths no greater than from 6 to 10 feet. The bottoms are usually of a soft mud very easily stirred up and moved by wave action. The shores are marshy, readily eroded and changed by the same cause. The marshland is, as a rule, about 2 feet above mean low Gulf level; the timbered areas are a little higher, averaging probably 3 feet, while the banks of the larger bayous are at an elevation of about 10 feet. The land high enough to admit of cultivation is extremely fertile, and the climate permits more than one crop a year. Several of the bayous are lined with houses to such an extent that the banks resemble village streets. This district can best be considered under three sections, as follows: From the Mississippi River to Bayou Teche; from Bayou Teche to the Mermentau River; from the Mermentau River to the Sabine River.

Mississippi River to Bayou Teche.—This section is, in physical features, as just described; it forms the center of the sugar region.

Louisiana, with extensive rice fields; the lower portion in the vicinity of the Gulf has a large trade in fish and oysters and is the location of many oyster canneries. It is crossed by Bayous Barataria, Des Allemands, Lafourche, Terrebonne, Little Caillou, Grand Caillou, Black, Boeuf, the Atchafalaya River, and many other bayous, all navigable. The principal lakes are Salvador, Cataouache, Des Allemands, Field, Long, Verret, Palourde, and Grand Lake, which is an enlargement of the Atchafalaya River. This Grand Lake and Atchafalaya River are joined by a network of bayous and lakes in Plaquemine Bayou, which is connected by a lock with the Mississippi River 110 miles above New Orleans, so that boats can pass from the Teche and Atchafalaya River to that city. This lock was built by the United States and no tolls are charged for passage through it.

Two private canal routes, the Harvey Canal and the Company Canal, extend from New Orleans partly across this section. The Harvey Canal is connected with the Mississippi River by a lock at Harvey, La., opposite Jackson Avenue in New Orleans, about 2½ miles above Canal Street. The lock has a width of 29 feet 11 inches, available length of 150 feet, and depth of 7 feet over the miter sills. From the lock the canal has a depth of about 6 feet and width of about 70 feet for 5.4 miles to Bayou Barataria, through which and Bayou Villars ample depth exists for a distance of 12.4 miles to Lake Salvador. The route across that lake is almost 12 miles to the entrance to the Harang Canal, as this piece of canal belonging to the same company is named, it having but recently come into their possession. This Harang Canal, 7.3 miles long, connects Lake Salvador with Bayou Lafourche. It was the intention of the company to extend their route by cutting a canal from Bayou Lafourche to Bayou Terrebonne; a survey party was in the field making the location, but was withdrawn when the act of Congress directing this report was passed.

One steel highway swing bridge and two plate-girder railroad swing bridges cross the canal a short distance below the lock, making connection with the Mississippi. The railroad bridges have clear openings of 36 feet and are probably sufficient for all traffic which is likely to use the canal. The highway bridge would probably have to be rebuilt if the canal were enlarged.

The ownership of the canal is in the Harvey Canal & Land Improvement Co., legally a corporation of a small number of stockholders, but practically a partnership. Its right of way is about 300 feet wide. The other canal leading west from the Mississippi opposite New Orleans is ordinarily known as the "Company Canal," it having been constructed about 1830 by the Barataria & Lafourche Canal Co. It is now owned at present by Mr. R. R. Barrow. It is connected with the Mississippi at Westwego, La., opposite Walnut Street, New Orleans, about 6 miles above Canal Street, by a lock having a width of 25 feet, a length of 160 feet, and a depth of 6 feet. The canal is about 10 miles long to Bayou Segnette. This bayou is very crooked and several cut-offs have been made to relieve navigation, and through them the distance traversed from the canal to Lake Salvador is 8.8 miles. The route usually followed across the lake to the mouth of Bayou Des Allemands is about 13 miles in length. Leaving this

bayou about a mile from the lake the canal runs through swamps about 13 miles to Bayou Lafourche at Lockport. From this point it has been extended 8 miles through the swamp and across Lakes Folsom and Long to Bayou Terrebonne about $8\frac{1}{2}$ miles below Houma. Boats run regularly from Houma to New Orleans. The canal is supposed to have a depth of 6 feet, but there is reason to believe that parts have shoaled to 4 feet, although, as the proprietor is constantly engaged in work of maintenance, this shoaling may be temporary. This canal, like the Harvey Canal, is crossed just below the lock by the Texas & Pacific and Southern Pacific Railroads by single-track swing bridges with a clear opening of 36 feet, and also one wooden highway bridge. The last would probably have to be reconstructed were the canal enlarged. Between Bayou Des Allemands and Bayou Lafourche the canal is crossed by a branch of the Southern Pacific Railroad, one narrow-gauge railroad, and two highway swing bridges, one of the last of which—that on the eastern bank of Bayou Lafourche—would probably have to be rebuilt. There is a highway bridge on the western bank of this bayou, and another on the eastern bank of Bayou Terrebonne which would require rebuilding. As the highways were in existence before the canal was built the cost of the bridges has devolved upon the canal owners, and would probably devolve upon the United States should it acquire the waterway. The railroads having come subsequent to the canal, those bridges have been constructed and maintained at the expense of their respective companies. The right of way of the canal varies, being 100 arpent (about 192 feet) wide at some points, 208 feet at others, and 300 feet in one or two places.

Letters were addressed to the owner of each canal requesting information concerning the prices at which their properties could be acquired by the United States. The owners of the Harvey Canal made no written reply but stated verbally that, while not caring to sell, they realized that the property would be of diminished value should the United States open a parallel route free from toll, and they would therefore, when the time came, sell the property for what it had cost, and in order that this amount might be ascertained they were willing to open their books to the United States for examination. Mr. Barrow quoted a price in writing, but afterwards requested that it be not made public, and stated that he would be willing to dispose of the Company Canal upon the same basis as that named by the Harvey Canal Co. This proposition is not exactly advantageous to the United States, for, as these canals were originally excavated prior to 1860 and before the existence of modern dredging machinery, the cost must have been considerably higher than the same amount of excavation would be to-day by modern dredges. Also, the locks would, in each case, have to be rebuilt, as they are regarded as too small for the craft which would use the inland waterway. A distinction should also be carefully made between cost of construction and cost of maintenance. Efforts to obtain a statement of amount of stock outstanding have not been successful.

According to the map the best route from Bayou Terrebonne westward to the Atchafalaya appears to be offered by Bayou Black, which is navigable to within about 10 miles of the Terrebonne, and affords a good waterway from that point to the Atchafalaya by way of Bayou Boeuf. Bayou Black approaches to within less than 1 mile of the

Terrebonne at Houma, and an effort was made some years ago by private parties to dig a canal through that town between the streams in order to deepen the Black to where sufficient water existed naturally, but the work was abandoned after a small proportion had been accomplished.

The people at Houma are anxious that the waterway should pass through that place, and both the short distance between the two bayous and also the fact that the locality had been selected by private capital made it seem likely to be economical, and it was accordingly the first route examined by the board, although not finally selected. Estimates were accordingly prepared for two lines, one following the route of the Company Canal to Bayou Terrebonne, thence up that stream to Houma, through that town by canal to Bayou Black, and barging that bayou until a point was reached having a natural depth of 9 feet; the other by the route of the Harvey Canal to Bayou Lafourche, up this stream to Lockport, thence following the route of the first estimate. The resulting figures are as follows, all excavation being computed at \$0.15:

Five-foot waterway from the Mississippi, via Company Canal, through Houma, to the Atchafalaya and Bayou Teche.

Mississippi River to Lake Salvador, 1,306,000 cubic yards.....	\$195, 900
Modeling lock.....	52, 000
Lake Salvador and Bayou Des Allemands, 897,000 cubic yards.....	134, 550
Bayou Lafourche to Bayou Terrebonne, 1,786,000 cubic yards.....	267, 900
Lake Salvador to Bayou Lafourche, 2,497,000 cubic yards.....	374, 550
Bayou Terrebonne, 2,260,000 cubic yards.....	339, 000
Bayou Terrebonne to Bayou Black, 409,000 cubic yards.....	61, 350
Bayou Black, 6,185,000 cubic yards.....	927, 750
Total (15,340,000 cubic yards).....	2, 353, 000

Purchase of canal property uncertain and not included.

Five-foot waterway from the Mississippi, via Harvey Canal, to Bayou Lafourche, thence via Company Canal to the Terrebonne, and through Houma to Bayou Black and the Atchafalaya.

Mississippi River to Lake Salvador, 950,000 cubic yards.....	\$142, 500
Modeling lock.....	52, 000
Lake Salvador, 771,000 cubic yards.....	115, 650
Lake Salvador to Bayou Lafourche, 1,283,000 cubic yards.....	192, 450
Bayou Lafourche, 962,000 cubic yards.....	144, 300
Bayou Lafourche to Bayou Terrebonne, 1,786,000 cubic yards.....	267, 900
Bayou Terrebonne, 2,260,000 cubic yards.....	339, 000
Bayou Terrebonne to Bayou Black, 409,000 cubic yards.....	61, 350
Bayou Black, 6,185,000 cubic yards.....	927, 750
Total (14,606,000 cubic yards).....	2, 242, 900

Purchase of canal property uncertain and not included.

There are 31 bridges in existence over each route, including those already mentioned. They are 3 railroad bridges, 3 narrow-gauge plantation railroad bridges, 1 steel highway bridge, 22 wooden highway bridges, and 2 foot bridges. Of these 21 are on Bayou Terrebonne and Bayou Black, navigable waters of the United States, some of those over the latter being fixed bridges. The only expense in account of these structures which might devolve upon the United States would be for rebuilding the 5 highway bridges over the existing canal.

On account of the large amounts involved the board considered advisable, before reaching a definite conclusion or making a recommendation, to ascertain the cost of a somewhat smaller canal and consider its applicability to the probable traffic.

It is believed that the principal reason for which a depth of 9 feet in the waterway was desired by those interested in its construction was to permit coal to be distributed throughout this region in barges and boats in which it is brought down the Mississippi or may be brought from Mobile. For all coal from the Alabama fields a depth of 7 feet will be sufficient, as has previously been shown. Inquiry among those interested in the Ohio River coal trade led to the opinion that there will be no difficulty in carrying coal economically through the inland waterway upon 7-foot draft, as barges consigned from Pittsburgh to points west of the Mississippi could be loaded accordingly at that point or trimmed at New Orleans. The other principal articles of commerce such as cotton, cotton seed, sugar, rice, and general freight can be readily handled upon a 7-foot draft, and the vessels employed will probably have less, as they will for the purpose of distributing and gathering freight, run into the numerous bayous intersecting the inland waterway, and it will be the depth in these branches, or commercial feeders, of the waterway which will control their draft rather than that of the waterway itself.

Both economy of construction and saving of time in the movement of freight make desirable a waterway as nearly direct as can be obtained; it should preferably join the Mississippi River as near the business portion of the city of New Orleans as practicable.

It was considered advisable to pass from Bayou Terrebonne Bayou Black below Houma for the following reasons: The amount of excavation in the upper Black would be excessive; on account of the high ground bordering the upper bayou the cost per cubic yard would be higher than elsewhere, and on account of the thickly populated and highly cultivated condition of its banks, dumping ground would be greatly restricted, which would also add to the cost. Bayou Terrebonne is so restricted by buildings within the town limits of Houma that it would be difficult, and might be impossible, to secure the proper width of right of way.

For purposes of estimate and comparison two practicable routes were selected, both lying outside the lines of existing canals, and differing only in the fact that one includes Lake Salvador, while the other passes around that body of water.

Route No. 1, via Bayou Barataria and Lake Salvador.—This route starts near Harvey, La., and extends on a straight line nearly at right angles to the river, bearing east of south to Bayou Barataria a distance of 5.7 miles, nearly paralleling the Harvey Canal, or, in case the Harvey Canal could be acquired advantageously, it would follow the Harvey Canal. Thence, following Bayou Barataria to Bayou Villars to Lake Salvador, 11.5 miles, and across Lake Salvador on a straight line to the mouth of Bayou Des Allemands, 1.3 miles. Thence on a straight line 20.7 miles, to a point on Bayou Terrebonne, about 0.2 mile above the intersection of Bayou Terrebonne and Little Caillou, intersecting Bayou Lafourche, 1.6 miles below Lockport and 10.5 miles from Bayou Des Allemands. Thence on a straight line bearing slightly farther south than the previous reach, 4.5 miles, to a point just west of the high ground of Bayou

age. Thence, on a straight line slightly north of west, 3.7 miles to a point on Bayou Black near its southerly point, about 5.13 miles by the bayou below Houma, La. Thence, following Bayou Black to Bayou Boeuf to Morgan City, La., a distance of 35.2 miles. The total length of this route from the Mississippi to Morgan City is 38.9 miles. If existing canals are followed as far as already constructed, the distance will not be less than 104 miles. The dredging required on this route is as follows:

	Cubic yards.
Mississippi River to Bayou Barataria, firm ground.....	174, 000
Mississippi River to Bayou Barataria, swamp and marsh.....	915, 000
Bayou Barataria to Lake Salvador, none.....	210, 000
Lake Salvador.....	306, 000
Lake Salvador (Bayou Des Allemands) to Bayou Lafourche, firm ground..	1, 714, 000
Lake Salvador (Bayou Des Allemands) to Bayou Lafourche, swamp and marsh.....	460, 000
Bayou Lafourche to Bayou Terrebonne, firm ground.....	1, 563, 000
Bayou Lafourche to Bayou Terrebonne, swamp and marsh.....	658, 000
Bayou Terrebonne to Bayou Black, firm ground.....	1, 100, 000
Bayou Terrebonne to Bayou Black, swamp and marsh.....	2, 430, 000
Bayou Black, firm ground.....	9, 530, 000
Total.....	

Route No. 2, skirting Lake Salvador.—This route starts near Harvey, La., or, if the Harvey Canal could be acquired advantageously, at the Harvey Canal, and extends on a straight line nearly at right angles to the river and nearly paralleling or else following the Harvey Canal for a distance of 0.8 mile. Thence by a straight line bearing slightly west of south 1.8 miles to near the high ground bordering Bayou Des Allemands. Thence by a straight line to the mouth of Bayou Segnette 6 miles. Thence by a straight line 12.9 miles to a point on Bayou Des Allemands about 2.3 miles above its mouth. Thence 2.3 miles down Bayou Des Allemands to join route No. 1, and following that route as described above to Morgan City, La. The total length of this route from New Orleans to Morgan City, La., is 88.1 miles.

If the line be selected so as to pass outside of Lake Salvador, the amount of excavation between the Mississippi and Bayou Des Allemands, at the western end of Lake Salvador, would amount to 4015,000 cubic yards, which would make the total amount to be removed about 12,246,000 cubic yards, 923,000 being in firm ground. The estimated cost of a waterway 7 feet deep with 75 feet bottom width by each of the existing lines of canal as far as practicable passing below Houma, and also by routes 1 and 2 named above, is as follows:

Canal 7 feet deep, 75 feet bottom width, via Company Canal to Bayou Terrebonne, through Lake Salvador, thence by selected route.

Mississippi River to Lake Salvador, 783,600 cubic yards, at \$0.15.....	\$117, 540
Lake Salvador, 283,607 cubic yards, at \$0.15.....	42, 541
Lake Salvador to Bayou Lafourche, 1,498,200 cubic yards, at \$0.15.....	224, 730
Bayou Lafourche to Bayou Terrebonne, 1,071,600 cubic yards, at \$0.15..	160, 740
Bayou Terrebonne to Bayou Black, selected route, 1,758,000 cubic yards, at \$0.15.....	263, 700
Bayou Black, 2,430,000 cubic yards, at \$0.15.....	364, 500
Total.....	1, 173, 751

Purchase of canal property uncertain and not included.
Annual maintenance, \$20,000.

Canal 7 feet deep, 75 feet bottom width, via Harveys and Harang Canals, through Lake Salvador to Bayou Lafourche, thence by selected route.

Mississippi River to Lake Salvador, 570,000 cubic yards, at \$0.15.....	\$85, 5
In Lake Salvador, 171,437 cubic yards, at \$0.15.....	25, 7
Lake Salvador to Bayou Lafourche, 769,800 cubic yards, at \$0.15.....	115, 4
In Bayou Lafourche, 577,200 cubic yards, at \$0.15.....	86, 5
Bayou Lafourche to Bayou Terrebonne, 1,071,600 cubic yards, at \$0.15....	160, 7
Bayou Terrebonne to Bayou Black, selected route, 1,758,000 cubic yards, at \$0.15.....	263, 7
In Bayou Black, 2,430,000 cubic yards, at \$0.15.....	364, 5
Total.....	1, 102, 2

Purchase of canal property uncertain.

Annual maintenance, \$20,000.

Canal 7 feet deep, 75 feet bottom width, between the Mississippi River and Bayou Teche route 1, described above (through Lake Salvador).

Excavation, 9,530,000 cubic yards, at \$0.15.....	\$1, 429, 5
Lock	120, 0
2 railway swing bridges, at \$40,000.....	80, 0
13 highway bridges, at \$2,000.....	26, 0
Total.....	1, 655, 5

Maintenance, \$25,000.

Canal 7 feet deep, 75 feet bottom width, between the Mississippi River and Bayou Teche route 2, described above (outside of Lake Salvador).

Excavation, 12,246,000 cubic yards, at \$0.15.....	\$1, 836, 9
Lock.....	120, 0
2 railway bridges, at \$40,000.....	80, 0
13 highway bridges, at \$2,000.....	26, 0
Total.....	2, 062, 9

Maintenance, \$20,000.

Owing to the fact that Congress has authorized the construction of a waterway 5 feet in depth with 40 feet bottom width across the State of Louisiana west of the Atchafalaya and the Teche, and has made appropriation for a considerable portion of this work, estimates are included for a canal of this size along the four routes for which estimates for a 7-foot canal have just been given.

Via Company Canal to Bayou Terrebonne, thence by selected route (through Lake Salvador)

Mississippi River to Lake Salvador, 60,000 cubic yards, at \$0.15.....	\$9, 0
In Lake Salvador, 15,000 cubic yards, at \$0.15.....	2, 2
Lake Salvador to Bayou Lafourche, 270,000 cubic yards, at \$0.15.....	40, 5
Bayou Lafourche to Bayou Terrebonne, 199,000 cubic yards, at \$0.15.....	29, 8
In Bayou Terrebonne, nothing.	
Bayou Terrebonne to Bayou Black, selected route, 703,200 cubic yards, at \$0.15.....	105, 4
In Bayou Black, 278,362 cubic yards, at \$0.15.....	41, 7
13 highway bridges, at \$2,000.....	26, 0
Total.....	254, 8

Purchase of canal property uncertain and not included.

Annual maintenance, \$20,000.

Via Company Canal, skirting Lake Salvador.

of above route	\$254, 834
ditional excavation, 821,380 cubic yards, at \$0.15.....	123, 207
Total.....	378, 041

Harveys and Harang Canals route to Bayou Lafourche, thence by selected route (through Lake Salvador).

Mississippi River to Bayou Barataria, 435,600 cubic yards, at \$0.15	\$65, 340
Bayou Barataria to Lake Salvador, none.	
Lake Salvador, 31,200 cubic yards, at \$0.15	4, 680
Lake Salvador (Bayou Des Allemands) to Bayou Lafourche, 808,000 cubic yards, at \$0.15.....	121, 200
Bayou Lafourche to Bayou Terrebonne, 809,200 cubic yards, at \$0.15	121, 380
Bayou Terrebonne to Bayou Black, 703,200 cubic yards, at \$0.15.....	105, 480
Bayou Black, 279,362 cubic yards, at \$0.15.....	41, 754
Highway bridges, at \$2,000.....	26, 000
Total.....	485, 834

Purchase of canal property uncertain.
Annual maintenance, \$20,000.

Via Harveys and Harang Canals, skirting Lake Salvador.

of above route	\$485, 834
ditional excavation, 1,646,000 cubic yards, at \$0.15	246, 900
Total.....	732, 734

The amount of material which has been removed from the Harvey Canal prism as it exists is estimated as 485,000 cubic yards, and from the Harang Canal prism 523,000 cubic yards, or a total of 1,008,000 cubic yards for both. These quantities do not represent all that has been removed from the canals by their owners, but they are approximately all that would be saved in excavation were these canals adopted as part of the route of the inland waterway. The amount which has been removed from the prism of the Company Canal as it exists to-day is estimated as 1,528,800 cubic yards, but as much of the material has been deposited upon the bank, a considerable portion would have to be rehandled were the property acquired and enlarged to 75 feet. By purchasing either canal property the cost of railroad bridges would be avoided. The lock in either canal would have to be remodeled at a cost somewhat less than that for a new construction. If the Harvey Canal were obtained, the point of entrance to the Mississippi would be nearer the business center of New Orleans than that of the Company Canal, while the latter would give a line about 4 miles shorter to the Mississippi River, and would be that much more advantageous for traffic to points above the city. The waterway should be of great benefit to the section of State through which it passes. The land is of such character and so cut up by bayous and lakes that railroad construction is impossible, and no other method of communication than by water is practicable. The construction at private expense of the two canals named and several others not connected with the subject of this report illustrates the necessity for that means of transportation.

Morgan City, on the Atchafalaya, and the towns along the Teche now have access to the Mississippi River at Plaquemine by way of the Atchafalaya River and waters connecting with Plaquemine Bayou, but the distance to New Orleans is almost double by this

route what it would be by the route indicated above for the inland waterway. The opening of the lock at Plaquemine caused a reduction in freight rates from New Orleans to places on Bayou Teche, and more general reductions would inevitably result from the construction of a slack-water route of half the length.

The board recommends that the section of the inland waterway between the Mississippi River and Bayou Teche be constructed 7 feet deep and 75 feet wide at bottom; that the route follow either the Harvey or Company Canal, could either of these properties or portions of them be acquired at such price as would make the total cost less than that for new work, and in the case of a new line that it follow approximately the route indicated above. As the canal can be located frequently a mile or more to one side or the other, and sometimes farther without appreciably affecting the cost, the board believes inadvisable to designate any line absolutely; for subsequent developments of difficulties concerning the right of way may indicate somewhat different position as preferable at a subsequent date. It is believed advisable to include Lake Salvador in the route in order to keep the cost as low as possible. Should it be found by experience difficult to maintain the channel in the lake, the canal could then be cut through the marsh on the north, as indicated, at practically the same cost as if done at first.

Other routes.—In a country of such low elevation it is evident that the number of routes can easily be very considerable, and that to describe the possible variations of routes or combinations of existing waterways which might be utilized is unnecessary. Of the many considered, two are mentioned which the board was requested to adopt.

The joint organization of the Atchafalaya and Lafourche levee boards offered to secure the right of way by the Cane River Canal at Lake Verret. This canal is now being excavated by the State of Louisiana for the double purpose of a drainage canal and as a feed to Bayou Lafourche. By extending it to Lake Verret, communication would be opened between the Lafourche and the Atchafalaya, the lake being one of the parts of the river system. The route is, however, not regarded as being as good as that recommended, for it passes through the section adjacent to the upper Lafourche, which already has both water and rail communication; also from Morgan City to Lake Verret it would pass through a district which would derive no benefit whatever, being subject to overflow and not cultivated. The cost for excavating would be slightly less than for the route recommended, but the construction of one additional railroad swing bridge and two plantation railroad bridges would be required. The other route involves only the portion between the Mississippi and Bayou Barataria. The Algiers outfall canal, with suitable right of way, was offered free of cost. This would make the distance from Lake Salvador to the Mississippi several miles longer and would require more excavation than to some point on the river above Algiers. A railroad bridge, highway bridge, and a new lock would be required. The offer would be worth considering, however, should the price asked for the canal properties be excessive and there be difficulty in securing a right of way for a new location.

Bayou Teche to Mermentau River.—The physical features in this section are almost identical with those in the section from the Mississippi River to Bayou Teche just described practically the only difference being the narrower width of marsh, owing to the fact that salt water extends farther inland. Congress has already recognized the value of an intercoastal waterway through this region, and, by the river and harbor act of March 2, 1907, made appropriation for a canal of 5 feet depth and 40 feet bottom width from Bayou Teche to the Mermentau River, following the route laid down by Major Jadwin in his report upon the interior waterway from the Rio Grande to the Mississippi, published as House Document No. 640, Fifty-ninth Congress, second session. The route stated in this report was to extend from the Teche at Franklin to the nearest point of Cote Blanche Bay, an arm of the Gulf of Mexico, and thence into Vermilion Bay, another body of salt water, to Schooner Bayou, thence by canal to White Lake, and from White Lake to Collicon Bayou and Grand Lake, an enlargement of the Mermentau River. This route was selected on account of the small amount of excavation which would be required in the original construction. The fact has, however, since developed that the route is impracticable through Cote Blanche and Vermilion Bays, and inadvisable in the large lakes, on account of the soft character of the bottom and the resulting instability of any dredged channel to fill under wave action. The exposure and roughness of these bodies of water render them also unsuitable for navigation by vessels of a class which would use the canal. Due to these facts, Congress, by the river and harbor bill of March 3, 1909, authorized the Secretary of War to select such other point on Bayou Teche as the eastern terminus of the canal as might be found most advisable. It is believed to be good policy to locate the route of the 5-foot canal along such lines that it can be subsequently enlarged to a 7-foot or 9-foot canal, as may be found desirable. The depths in Cote Blanche Bay are such that a 9-foot canal would practically have to be dredged the entire length of the bay, and dredging would also be required a larger part of the distance through Vermilion Bay for a waterway of 7 feet in depth. Any channel which may be dredged would practically be obliterated within a year, and the board, under these circumstances, regards any route through these bays as impracticable. The route along the north side of Vermilion Bay will have to be through the marsh and is well defined by the simple condition of selecting the shortest line. Between Bayou Carlin, at the northeast corner of Vermilion Bay, and the Teche a large number of routes are available; from Bayou Carlin to the Mermentau they coincide; the principal ones, beginning with the most northerly one considered, are as follows:
From the Teche in the vicinity of New Iberia, via the partially constructed New Iberia drainage canal and Bayou Carlin, a distance of 15 miles, to the meeting point of the different routes near the mouth of Bayou Carlin.

The next route to the south is from the vicinity of Jeanerette, following the St. Mary and New Iberia drainage canal, Bayou Gasco, Weeks Bayou and Bayou Carlin to the common point. The distance is practically the same as from New Iberia, about 15 miles. The third route considered leaves Bayou Teche at Franklin and proceeds about 1 mile to Bayou Yokely, thence partly by that

bayou and a drainage canal to the St. Mary and Iberia branch drainage canal, Bayou Gaspego, and Weeks Bayou to Bayou Carlin, a distance of 24.8 miles.

The fourth line leaves the Teche by the Hanson Canal about 10 miles below Franklin, thence by Bayou Portage, Bayou Bartholomew, Bayou Chicot to Hog Bayou, and thence through the marshes to Weeks Bayou and Bayou Carlin, the total distance being 24.5 miles.

The fifth route starts from the Teche in the vicinity of Centerville and proceeds on a straight line for about 1 mile to Thorgersen's drainage canal, following this canal for a distance of $5\frac{1}{2}$ miles to Beaus Bayou, thence by Beaus Bayou, Birch Bayou to Bayou Bartholomew, thence by the same line as the preceding route, the total length being 29 miles.

Each one of these routes, except the fourth, will require the construction of a lock at a point of departure from the Teche, of a double-track swing bridge in the Southern Pacific Railroad, of plantation railroad bridges, and about three highway bridges. A lock exists on the Hanson Canal, and this route will require a double-track railroad swing bridge and a highway swing bridge only. The first three will each require the erection of one single-track railroad bridge in addition to the structures named above.

The line along the north side of Vermilion Bay would start from Bayou Carlin about a half mile above the mouth of that stream to Weeks Bay, as the northeast corner of Vermilion Bay is named there. It would run thence in a northwesterly direction about $6\frac{1}{2}$ miles to a point on Salt Mine Bayou, thence in a southwesterly direction about 13 miles to Bayou Vermilion. A 9-foot canal would involve an excavation of 4,423,000 cubic yards between Bayou Carlin and Bayou Vermilion. Between Bayou Vermilion and the Mermentau River a 9-foot canal, following the route hereinafter recommended for a 7-foot waterway and lying north of White and Grand Lakes, would involve the excavation of 8,800,000 cubic yards.

The board, however, believes that a canal 7 feet in depth will answer all purposes in this section, as in the one farther to the east.

Route.	Excavation.				Estimated cost.				Grand total.			
					Bayou Teche to Bayou Carlin.					Carlin to Vermillion.	Vermillion to Mermentau.	
	Bayou Teche to Bayou Carlin.	Bayou Carlin to Vermillion Bayou.	Vermillion Bayou to Mermentau River.	Total.	Excavation.	Bridges.	Lock.	Total.				
	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>								
New Iberia, route No. 2.....	3,330,000	4,423,000	8,800,000	16,553,000	\$499,500	\$116,000	\$50,000	\$665,500	\$663,450	\$1,320,000	\$2,648,950	
Jeanerette, route No. 2.....	2,988,000	4,423,000	8,800,000	16,211,000	448,200	116,000	50,000	614,200	663,450	1,320,000	2,597,650	
Franklin, route No. 2.....	5,750,000	4,423,000	8,800,000	18,973,000	862,500	76,000	50,000	988,500	663,450	1,320,000	2,971,950	
Hanson Canal, route No. 2.....	4,670,000	4,423,000	8,800,000	17,893,000	700,500	62,000	(1)	827,500	663,450	1,320,000	2,810,950	
Centerville, route No. 2.....	5,400,000	4,423,000	8,800,000	18,623,000	810,000	116,000	50,000	976,000	663,450	1,320,000	2,959,450	

7 FEET DEEP AND 75 FEET WIDE ON THE BOTTOM, LYING NORTH OF WHITE LAKE AND GRAND LAKE.

	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>							
New Iberia, route No. 2.....	2,204,000	3,075,000	5,700,000	10,979,000	\$330,600	\$116,000	\$50,000	\$496,600	\$461,250	\$855,000	\$1,812,850
Jeanerette, route No. 2.....	2,138,000	3,075,000	5,700,000	10,913,000	320,700	116,000	50,000	486,700	461,250	855,000	1,802,950
Franklin, route No. 2.....	3,368,000	3,075,000	5,700,000	12,143,000	506,200	76,000	50,000	631,200	461,250	855,000	1,947,450
Hanson Canal, route No. 2.....	2,840,000	3,075,000	5,700,000	11,615,000	426,000	62,000	(1)	553,000	461,250	855,000	1,869,250
Centerville, route No. 2.....	3,420,000	3,075,000	5,700,000	12,195,000	513,000	116,000	50,000	679,000	461,250	855,000	1,995,000

5 FEET DEEP AND 40 FEET WIDE ON THE BOTTOM.

	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>	<i>Cubic yards.</i>							
New Iberia, route No. 1.....	766,000	1,342,200	2,108,800	4,217,000	\$114,900	\$116,000	\$50,000	\$280,900	\$201,330	-----	\$482,320
Jeanerette, route No. 1.....	599,600	1,342,200	1,941,800	3,883,600	89,940	116,000	50,000	255,940	201,330	-----	457,270
Franklin, route No. 1.....	1,454,100	1,342,200	2,796,300	5,592,600	218,115	76,000	50,000	344,115	201,330	-----	545,445
Hanson Canal, route No. 1.....	992,300	1,342,200	2,334,500	4,679,000	148,845	62,000	(1)	275,845	201,330	-----	477,175
Centerville, route No. 1.....	1,420,150	1,342,200	2,762,350	5,524,700	213,022	116,000	50,000	379,022	201,330	-----	580,352

1 Purchase of Hanson Canal property, \$65,000.

Canal from Bayou Teche to Mermentau River—Continued.
5 FEET DEEP AND 40 FEET WIDE ON THE BOTTOM, NORTH OF WHITE LAKE AND GRAND LAKE.

	Additional excavation.	Cost of additional excavation.	Cost of route No. 1.	Total.
New Iberia, route No. 2.....	2,398,600	\$359,790	\$482,320	\$842,110
Jeanerette, route No. 2.....	2,398,600	359,790	457,270	817,060
Franklin, route No. 2.....	2,398,600	359,790	545,445	905,235
Hanson Canal, route No. 2.....	2,398,600	359,790	477,175	836,965
Centerville, route No. 2.....	2,398,600	359,790	580,352	940,142

Cost of double-track railway bridges (each), \$60,000; single-track railway bridges (each), \$40,000; plantation railway bridges (each), \$5,000; highway bridges (each), \$2,000; purchase of Hanson Canal property, \$65,000; estimated cost of dredging, 15 cents per cubic yard; maintenance, \$25,000.
Route No. 1 passes through White and Grand Lakes. Route No. 2 lies north of White and Grand Lakes.

The board regards the Hanson Canal route as the best between Bayou Teche and Bayou Carlin, after which it believes the Centerville, Franklin, and Jeanerette routes advisable in the order named. The cost of the New Iberia route is practically the same as that of the Jeanerette route, but the distance for all vessels bound to the Gulf of Mexico and the Mississippi River is several miles more by New Iberia than by Jeanerette. Both the New Iberia and Jeanerette routes have the disadvantage over those entering the Teche at Franklin or below of requiring all boats to traverse the large bend in the bayou between Jeanerette and Franklin. A route from the Gulf at Baldwin above Franklin would involve about the same elevation as a line from the latter point, but the long bend in the bayou between these points makes it less desirable. The line by way of the Hanson Canal offers the shortest route. The distance from Bayou Carlin to the mouth of Bayou Teche by the different routes are: New Iberia route, $66\frac{1}{2}$ miles; Jeanerette, 58 miles; by Franklin, 42 miles; the Hanson Canal, 38 miles; and by Centerville, 35 miles. The lock on the Hanson Canal was built for rafting purposes and is of excessive length, but as it is believed that it will answer all purposes for several years to come, no estimate is included for rebuilding it. A new lock of slightly greater width would cost the same as on the other routes—that is, about \$50,000.

The route for a 7-foot canal is not recommended through White Lake, for the reason that this lake has a depth of only about 5 feet, and to construct a 7-foot waterway through it would require dredging across the entire length of the lake. The bottom being soft, this canal would be both difficult and expensive to maintain, and it is regarded as preferable to incur the somewhat greater initial cost of constructing a canal outside this lake.

The above estimate is therefore made along the following route, from Bayou Vermilion to Mermentau, termed route No. 2 in the report for this section: Beginning at a point on the Vermilion about 1 mile above its mouth, thence by a canal in a southwesterly direction a distance of nearly 3 miles to a point on Bayou Chene about 600 feet above its mouth, thence in practically the same direction for one mile to a point on Schooner Bayou about 1,500 feet above its mouth, thence following Schooner Bayou for $4\frac{1}{2}$ miles to where the present 5-foot canal leaves it, thence following that waterway by enlarging the canal for about 3 miles farther to a point south of the Prairie Ridge, thence in a northwesterly direction about $23\frac{3}{10}$ miles to the Gueydan drainage canal, joining it about 500 feet above its mouth, thence in a westerly direction, skirting the northern part of Grand Lake and following the low land as nearly as possible for 15 miles to the Mermentau River, which it joins about 1,500 feet above its point where it enters Grand Lake. The total length of the above route from the Vermilion to the Mermentau is $42\frac{6}{10}$ miles, or from the point where the canal enters Bayou Vermilion $44\frac{8}{10}$ miles, $1\frac{8}{10}$ miles of that bayou being utilized. No dredging will be required in Bayou Vermilion and none in Schooner Bayou. The canal will lie almost entirely through low land and marsh.

The board recommends the construction of a waterway 7 feet deep with a bottom width of 75 feet from the Teche to the Mermentau along the line given, preferring the Hanson Canal route for the connection between the Teche and Bayou Carlin, but should that not

prove practicable, it regards the Centerville route as next desirable and the Franklin and Jeanerette routes as next in order of desirability. The advantages of this waterway are quite fully set forth in Maj. Jadwin's report above mentioned. Further report on this subject it is believed is not necessary, especially as Congress has already recognized the importance and value of this section.

Mermentau River to Sabine River.—This section resembles somewhat the two preceding sections, but differs from them slightly, having a less number of bayous and lakes, and, also, in having a large number of "ridges" or long narrow areas of solid ground rising to an elevation of 4 to 8 feet above Gulf level, sometimes for one mile or two in length and at times for a distance of 6 or 7 miles, their width being from one-half mile to a mile or more. The section is less fully settled than the two preceding, but is rapidly being developed, rice culture having been found most profitable. This section is divided into two parts by Calcasieu River and Lake, two navigable bodies of water. Maj. Jadwin's recommendation was to utilize Calcasieu Lake as part of the route of the inland waterway, but its soft bottom would cause the channel to fill quite rapidly, as the shores are quite shoal, considerable and constant dredging would be required. A channel was dredged through the center of this lake in 1906 to aid in navigation of Calcasieu River, but in surveys conducted during the summer of 1909 no distinct trace of this channel could be found, it having become filled to such an extent that it was practically obliterated.

The best route for the waterway between the Mermentau and Calcasieu is pretty closely defined by the necessity of keeping clear of the ridges, which would cause excessive excavation, and also of the small lakes, where the channel would require constant dredging. It starts from the Mermentau about 1,500 or 2,000 feet above its entrance into Grand Lake, skirts Grand Lake, and then goes north of Lacassine Bayou, Lacassine Lake, Bayou Misere, Lake Misere, Misere Canal, a private irrigation and drainage canal, Sweet Lake, and thence northwestwardly through the prairie to enter the Calcasieu River above its junction with Calcasieu Lake. The distance by this route from the Mermentau to Calcasieu is 32 $\frac{2}{10}$ miles. The number of cubic yards to be dredged for a canal 9 feet deep would be 8,684,900. A canal constructed along a straight line between the point of beginning named above and a point on Calcasieu River about 6,500 feet above the mouth of Bayou Choupique would have a length of 32 $\frac{2}{10}$ miles; the estimated amount of excavation for a canal 9 feet deep along this line is approximately 9,500,000 cubic yards. Two highways are crossed by each route.

The portion between the Calcasieu and Sabine requires a careful location of route, in order to avoid heavy dredging, than any other portion west of the Mississippi River. The ridges and small lakes mentioned occur more frequently and, if the line is not so located to avoid these as far as possible, the cost will be greatly increased. The route which appeared most practicable to the board, without taking the time and incurring the expense of making a very accurate topographic map, starts on the Calcasieu River at or near the mouth of Choupique Bayou and extends in a southwesterly direction for a distance of about 12 $\frac{1}{2}$ miles, skirting the northwest shore of Bayou Lake, thence west 7 $\frac{1}{2}$ miles to Black Bayou, thence by that bayou

distance of almost 11 miles to the Sabine River. This route lies entirely in low and marshy land, although one or two ridges are encountered. No dredging will be required in Black Bayou, except for cut-offs to avoid abrupt bends. The total length of the route from Calcasieu River to the Sabine is a little less than 31 miles. Estimated quantity of excavation for this route for a 9-foot canal 5,620,000 cubic yards. One public highway is crossed.

9 feet deep, 100 feet bottom width, from Mermentau River to Sabine River, by route going north of Lacassine and Sweet Lakes between the Mermentau and Calcasieu, and by Black Bayou into Sabine River.

Mermentau River to Calcasieu River, 8,684,900 cubic yards excavation, at \$0.15	\$1, 302, 735
Calcasieu River to Sabine River, 5,620,000 cubic yards excavation, at \$0.15	783, 000
Total.....	2, 085, 735
Annual maintenance, \$10,000.	

7 feet deep, 75 feet bottom width, between Mermentau River and Sabine River by the same route.

Mermentau River to Calcasieu River, 4,733,000 cubic yards, at \$0.15.....	\$709, 950
Calcasieu River to Sabine River, 3,188,000 cubic yards, at \$0.15.....	478, 200
Total.....	1, 188, 150
Annual maintenance, \$10,000.	

5 feet deep, 40 feet bottom width, between Mermentau River and Sabine River by the same route.

Mermentau River to Calcasieu River, 1,749,200 cubic yards, at \$0.15.....	\$262, 380
Calcasieu River to Sabine River, 1,275,200 cubic yards, at \$0.15.....	191, 280
Total.....	453, 660
Annual maintenance, \$12,000.	

The waterway in this section will, it is believed, be of great advantage to the community, not only to the territory on its banks but to a considerable extent of the States of Texas and Louisiana which might be considered tributary to it. It will enable lumber and rice to be distributed much more economically and brought to market at less cost than at present. It will also enable petroleum and its products to be placed upon the market at a less cost than is now possible with present means of transportation. The board believes that a canal cut in depth with a bottom width of 75 feet will answer all purposes for at least a considerable number of years to come.

The board recommends the construction of the waterway between Mermentau and Sabine, believing that it is a link of the waterway which will add considerably to the prosperity of the community through which it traverses and aid materially in development of the region adjacent to it. The board considered several other routes, but found none of them as economical or as well situated to accommodate the traffic as the two above given. A survey was made of that portion of these other routes between the Calcasieu and Sabine Rivers, following Choupique Bayou and across country to the Sabine River at Orange, Tex., but it was found to be less advantageous than

the route above described, the excavation involved being 3,980,000 cubic yards, compared with 3,188,000 cubic yards along the recommended.

Sabine River to Galveston Bay.—This section lies in the Dallas river and harbor district in charge of Capt. A. E. Waldron, Corps of Engineers, United States Army. The line begins at the Sabine River, follows the shore of Sabine Lake via a canal already in existence 10 feet deep and 16 miles long to the turning basin at the head of the Port Arthur Ship Canal. From the turning basin the line enters Taylor Bayou and follows the same for a distance of about 2 miles, thence along Salt Bayou, cutting across from bend to bend in a fairly direct line for a distance of approximately 10 miles, then turns in the direction approximately parallel with the coast, extending across marshy land approximately 22 miles until it enters the bay in the vicinity of High Island, thence for a distance of about 6 miles across the bends and windings of Mud and East Bayous to the head of East Galveston Bay, thence across this arm of the bay to Bolivar Peninsula and along the marsh of Bolivar Peninsula, approximately 20 miles, to deep water in the vicinity of Port Bolivar. The whole length of this route is, practically, 76 miles.

The line between the turning basin of the Port Arthur Ship Canal and Port Bolivar, a distance of 60 miles, will have to be excavated with the exception of a small portion which lies in or along Taylor Bayou. Estimated cost \$1,698,000.

There is at the present time 9 feet or more water connecting Sabine Pass with Port Arthur, Beaumont, and Orange, Tex. By this means considerable commerce in lumber, oil, etc., is handled on barges drawing up to 10 feet, which are towed through Sabine Lake to the Gulf and thence into Galveston Harbor by the outside route. Barges of this draft can be handled more easily, probably, by the outside route than through the inland waterway. The country adjacent to the line of the canal is a low marsh, practically level, with an elevation of from 1.5 to 2.5 feet above mean low tide. The land at present is used almost entirely for winter grazing purposes. A small portion in the vicinity of High Island is devoted to raising early garden truck. With the exception of High Island (200 inhabitants), there are no settlements between the Port Arthur Ship Canal and Port Bolivar.

The board can see no necessity at the present time for this section of the proposed waterway, and its construction can only be justified as a connecting link in a through waterway, and therefore the board can not recommend the improvement at this time.

An alternative route from the outlet of Keith Lake and connecting with the proposed canal at the point where it turns into a direct line parallel with the coast was considered. This route has some 100,000 cubic yards less excavation, but to use it the Government would be compelled to build two bridges, one for a railroad and the other for a wagon road. This is avoided by following Taylor Bayou, and, furthermore, the recommended route removes from the Port Arthur Ship Canal (a much congested waterway) all canal barge traffic.

For these reasons the board believes the Taylor Bayou route preferable should the canal be constructed.

Galveston to the Rio Grande.—This portion of the inland waterway is in the Galveston river and harbor district in charge of Capt. John C. Oakes, Corps of Engineers, United States Army.

The land bordering the Gulf the entire length of the Texas shore is very low, with a sandy ridge close to the water, behind which there are lagoons, lakes, bays, or bayous for the greater part of the distance. The waterway in question connects these various waters and, with the exception of a few miles between the Brazos River and Matagorda Bay, and at the junction of this waterway with the Rio Grande, the elevation of the route is not more than 1 or 2 feet above mean low water. The proposed waterway connects with the Gulf by various rivers, etc., dividing this subdivision of the line into five natural sections, viz:

- From Galveston to Brazos River.
- From Brazos River to Pass Cavallo.
- From Pass Cavallo to Aransas Pass.
- From Aransas Pass to Brazos Santiago.
- And from Brazos Santiago to the Rio Grande.

A preliminary examination of this project was made by Maj. Edgar A. Swin, Corps of Engineers, United States Army, which report was published in House Document No. 640, Fifty-ninth Congress, second session, and a report of a survey of that section between Pass Cavallo and Aransas Pass, with a branch connecting with the mouth of the Guadalupe River, thence to Cuero, was rendered by the same officer and published in House Document No. 336, Fifty-ninth Congress, second session.

A survey was also made of the section between the Brazos River and Matagorda Bay and a report was rendered November 19, 1908, by the district officer, which has been published as Congressional Document No. 3, Sixty-first Congress, second session.

The act of March 2, 1907, approved the project for a channel 5 feet deep and 40 feet wide between Galveston and the Brazos River, and this section has been completed to the project dimensions.

The same act approved the project for a channel of the same dimensions between Aransas Pass and Pass Cavallo, including the Guadalupe River to Victoria, Tex. This section has been completed and work is now being carried on for maintenance of same.

In view of these various surveys and the actual operations that have been carried on throughout the three sections of this subdivision, sufficient information was on file in the United States Engineer Office to enable estimates to be made for the channel 100 feet wide and 9 feet deep between Galveston and Aransas Pass without any actual field survey, but no definite information existed with reference to the two sections from Aransas Pass to the Rio Grande; the field work, therefore, has been confined to a survey of this last-mentioned portion of the route.

Galveston Bay to Brazos River.—The channel, 5 feet deep and 40 feet wide, having been excavated the whole distance where necessary between deep water in Galveston Channel to the Brazos River, it has been found inadvisable to change the location of the line of the proposed channel 100 feet wide and 9 feet deep, as very little, if any, improvement can be made, owing to the configuration of the land and water areas along this route. Any improvement that might result

from a relocation offers insufficient advantages to warrant abandonment of the work already performed.

The proposed route begins at the western end of the Galveston Channel and lies along the harbor front of Galveston Island to the Gulf, Colorado & Santa Fe Railway bridge across West Galveston Bay a distance of 4 miles, with depths over this distance of from 5 to 10 feet. From the drawbridge the line lies in an almost straight line through West Bay to Mud Island, opposite San Luis Pass, a distance of 21 miles. The natural depth of this bay is between $2\frac{1}{2}$ and 3 feet. The line then cuts across Mud Island and Bastrop Bay to Christ Point; thence across Oyster Bay to connect at the end of Oyster Bay with the Galveston and Brazos Canal; thence by way of the canal to the Brazos River, a distance of 15 miles, making a total distance from deep water in Galveston Channel to the Brazos River 40 miles.

This section of the inland waterway has been used for many years, the Galveston and Brazos Canal having been dredged in 1853; and before railroad communication between the points on the Brazos River and Galveston was obtained this route was used by light-draft vessels to carry the produce of the Brazos Valley to Galveston.

The total amount expended on West Galveston Bay and Brazos Canal project to January 1, 1910, is \$257,326.87, of which \$30,000 was for the purchase of the Brazos Canal and \$42,443.92 for maintenance.

Estimates of cost for a channel 9 feet deep, 100 feet wide on bottom, with side slopes 1 to 1.

Dredging:

4,108,000 cubic yards, within prescribed cross section, at \$0.15.....	\$616,200
One highway bridge.....	100,000

Total.....	626,200
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Annual maintenance, \$60,000.

At the present time there is very little commerce using this section of the canal, although there is a length of 50 miles of the Brazos River having a natural low-water depth of 5 feet or more, and supplies from the country adjacent could now be carried to Galveston through this section of the waterway, almost no produce being transported. However, until recently the depth in the Galveston and Brazos Canal has not been more than 4 feet and it is possible that with the additional depth now available a light-draft traffic may develop. There is approximately 16 feet across the ocean at the mouth of the Brazos, so that any vessel that would require a depth of 9 feet could easily go outside into the Gulf for the short distance of approximately 50 miles between the Brazos and Galveston Harbor. The board, therefore, does not believe that it is advisable to endeavor at the present time to obtain a channel 9 feet deep at this section of the waterway, believing that the present channel provides all necessary facilities for the development of light-draft traffic for a number of years to come. The board, therefore, recommends that this section be not considered worthy of further improvement until such time as it may be desired as a link in the through inland waterway.

Brazos River to Pass Cavallo.—For report of preliminary examination of this section of the inland waterway, attention is invited to House Document No. 640, Fifty-ninth Congress, second session; this document contains a description of the route and of the rivers connecting with this section, and also the towns adjacent which might be affected by the improvement. As a result of this report a survey was recommended and approved for the section in question, and the report of this survey was rendered on November 19, 1908, and published as River and Harbor Committee Document No. 3, Fifty-first Congress, second session. An estimate was submitted for a channel 40 feet wide and 5 feet deep, at an estimated cost of \$10,000, with annual maintenance of \$15,000. From the data then collected an estimate of the cost of a channel 9 feet deep has been made. For a description of the country and conditions and advisability of improving this section, attention is invited to the above-mentioned report.

The line of this section leaves the Brazos River just above the mouth and lies approximately parallel to the coast in the low, marshy region behind the sand ridge along shore to the San Bernard River; thence through a body of water known as Cedar Lake, which has a depth of approximately 1 foot and is at times filled with salt water from the Gulf during high tides; thence through the marshy land into Caney Creek, and, following the meanders of Caney Creek a short distance, crosses through a cut known as the Big Canal to Matagorda Bay; thence to deep water in Matagorda Bay, a distance of 25.6 miles, making the total length of this section of the proposed canal 52.1 miles. The best location for the proposed canal is easily determined until Matagorda Bay is reached, but it is doubtful whether the channel should be located in the bay extending in a straight line to the south channel across Dog Island Reef or follow the north shore of Matagorda Bay to the town of Matagorda, thence across the bay to Dog Island Reef. Owing to the large amount of silt and large number of logs brought into the bay by the Colorado River, it is thought best to keep as far from the mouth of that river as possible. After careful consideration, the board believes that the channel should be located in the bay as close to the south shore as possible, because while the maintenance of the channel along the north shore from damage done by wind and waves would be low, the maintenance due to silt entering the canal from the bay and the Colorado River would be very much greater; it is therefore thought best to locate this canal as close to the south shore of the bay as is economical in excavation leading direct to Dog Island Reef and connecting with the town of Matagorda by a branch leading across the bay. From the point $3\frac{1}{2}$ miles beyond Dog Island Reef there is a natural depth of 9 feet or more in the bay at Pass Cavallo.

In the report of the survey the channel of smaller dimensions mentioned above was recommended principally because of the fact that sections of the inland waterway had been opened on each side and seemed desirable to complete the route from Aransas Pass to Galveston to enable produce to be carried by the inland waterway route between these points. This argument, of course, does not apply to the proposed channel, as no section has as yet the requisite depth.

Estimated cost, Brazos River to 9 feet in Matagorda Bay.

Dredging:

8,276,800 cubic yards, at \$0.15.....	\$1, 24.
Branch from town of Matagorda to main channel, 486,000 cubic yards, at \$0.15.....	7.

Total.....	1, 31.
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Annual maintenance, \$60,000.

The country adjacent to this section of the inland waterway is practically uninhabited and the land is poor and probably will not be put under cultivation for many years to come. It is now used as grazing land and there appears to be, in the opinion of the board, no necessity for the excavation of a channel of the proposed dimensions at this time. In the report of the survey of this section, submitted November 19, 1908, by the district officer, it was recommended that a channel 5 feet deep and 40 feet wide be excavated for the purpose of connecting the adjacent links of the waterway of similar dimensions approved at that time and now completed, namely, the section from Galveston to Brazos River and from Matagorda Bay to Aransas Pass. The same arguments used by the district officer which induced him to recommend the approval of the project for the channel of those dimensions appeal to the board, and the board therefore recommends that this section be approved to the extent of providing a channel 5 feet deep and 40 feet wide on bottom at an estimated cost of \$400,000 and estimated annual maintenance of \$15,000.

Pass Cavallo to Aransas Pass.—As a result of the report of the examination printed in House Document No. 640, Fifty-ninth Congress, second session, the act of March 2, 1907, approved the project for a channel 40 feet wide and 5 feet deep through this section of the waterway and this channel has been completed, including a branch from the main line to the mouth of the Guadalupe River and thence by river improvement to Victoria, Tex.

The line of the shallow channel already completed is shown on the map submitted herewith; other lines have been considered and alternatives compared and the line recommended is the one which, in the opinion of the board, would be most satisfactory from a point of view of first cost and annual maintenance for the deeper channel. The line of the channel 5 feet deep was adopted as being the most economical for that depth, and an effort was made to take advantage of the natural depth of the bays, etc., where possible. For the deeper channel, however, little is to be gained by adopting the longer route as it is thought that the reduced cost of maintenance of the recommended line will more than counterbalance the disadvantage of abandoning the present line. This proposed line, therefore, starts at deep water at Pass Cavallo, follows McHenry's Bayou, thence to the north of Grass Island, thence in a direct line across Espiritu Santo Bay to Steamboat Pass, thence in a direct line across San Antonio Bay to the shore at False Live Oak Point, thence along the shore across the marshy land through Mullet's Bay and entering the indentation of Aransas Bay as shown on the map, thence in a direct line to Half Moon Reef. From this point to Aransas Pass there is a natural depth of 9 feet, except at one point in the channel between Rockport and Aransas Pass opposite the quarantine station on Labor Island where there is but 7 feet.

is proposed to abandon the present branch channel to the Guadalupe River because of the practical impossibility of keeping open a channel 9 feet deep across the delta at the mouth of the river on account of the amount of silt and snags brought down by the river floods. The proposed location of the branch leaves the main line of the Live Oak Point, follows along the shore to the entrance to Matagorda Bay, thence across this bay to a point near the river above its mouth, and thence across the delta into the river.

The adopted project for the Guadalupe River from its mouth to Victoria provides for a channel 40 feet wide and 5 feet deep. From information at hand and obtained during the survey of the river (H. Doc. 336, 59th Cong., 2d sess.), it was estimated that 5 feet of water could be obtained from Victoria to the mouth for \$49,500 and that the annual maintenance would be \$15,000. To the end of the fiscal year \$68,258.60 had been expended on this river without attaining the desired results. Snags were brought down the river in such quantities that at no time could the low-water depth be taken advantage of, and the low water during the past year has been at least a foot lower than for many years, and from 2 to 3 feet lower than when the survey was made. It has not been possible, up to the present time, to navigate this stream except within a few miles of the mouth. There is not sufficient low-water discharge to make it possible to obtain 9 feet depth by open-river improvement. To obtain a channel 9 feet deep will, therefore, require improvement by locks and dams.

At the point where the proposed line connects with Matagorda Bay at Pass Cavallo, sand moves along the shore at both ebb and flood tides and during storms. To keep the entrance open will require a dike on each side of the channel extending at least to the 9-foot contour and these dikes must be sufficiently substantial to withstand the action of considerable force.

Estimated cost, excavation, Pass Cavallo to Aransas Pass.

Excavation:	
Main line, 4,512,000 cubic yards, at \$0.15.....	\$676, 800. 00
Branch from main line to Guadalupe River, 2,181,200 cubic yards, at \$0.15.....	327, 180. 00
Dikes.....	100, 000. 00
Guadalupe River from mouth to Victoria, 52 miles:	
Lock No. 1, mile $12\frac{1}{2}$, 8-foot lift.....	140, 000. 00
Lock No. 2, mile $20\frac{2}{3}$, $12\frac{1}{2}$ -foot lift.....	200, 000. 00
Lock No. 3, mile $32\frac{1}{4}$, 10-foot lift.....	150, 000. 00
Lock No. 4, mile 41, $4\frac{1}{2}$ -foot lift.....	125, 000. 00
Lock No. 5, mile $45\frac{1}{2}$, 9-foot lift.....	150, 000. 00
Dredging 38,760 cubic yards, at \$0.20.....	7, 752. 00
Dredge.....	75, 000. 00
Contingencies, 10 per cent.....	295, 173. 20
Total.....	3, 246, 905. 20

Annual maintenance, \$100,000.

The channel has been dredged through this section of the waterway to a depth of 5 feet and 40 feet wide, but as yet no commerce has developed. The principal argument which led to the approval of the project for this section was that the town of Victoria, using the Guadalupe River as its inland waterway, would ship its produce and obtain its supplies by water. Up to the present time the Government has not been

successful in obtaining a channel of the project dimensions in Guadalupe River, so that no produce has been shipped by this route. It is thought that the proposed channel will be obtained during the present year and that then it will be possible for Victoria to use the river and this canal if the conditions are such as to enable the interested parties to use water transportation in competition with the railroads. In view of these facts the board believes that this channel should be maintained under the adopted project but that no further improvement should be made until such time as conditions may make such improvement necessary. The board therefore recommends that this section be not considered worthy of further improvement at the present time.

Aransas Pass to Brazos Santiago.—Parties were sent into the field and a survey made for the purpose of determining the best location and cost of the proposed channel. This section starts at deep water at Aransas Pass, follows the Turtle Cove Channel to the 9-foot depth in Corpus Christi Bay, thence in a direct line across Corpus Christi Bay to Flour Bluff. Turtle Cove Channel has been excavated to a depth of 8 feet and has maintained that depth, with the exception of a short distance where the channel connects with Corpus Christi Bay where a slight shoaling has taken place, decreasing the depth to approximately 7 feet. There is a natural depth of 9 feet or more across Corpus Christi Bay to within a short distance of Flour Bluff. Beginning at this latter point the proposed line enters the Laguna Madre and follows the shore of the mainland to Point Isabel opposite Brazos Santiago. This laguna is a large body of salt water, extending from Corpus Christi Bay to within $3\frac{1}{2}$ miles of the Rio Grande River a distance of 123 miles, and has a width of from 2 to 10 miles; it is separated from the gulf by Brazos and Padre Islands. Padre Island extends from Corpus Christi Bay to Brazos Santiago, a distance of 113 miles. It is a low, sandy cordon, having in places sand hills of some height, but in other places being sufficiently low to be overflowed by high storm tides.

The laguna is very shallow, having a depth at low tide from 18 inches to 7 or 8 feet. Over a greater portion of its area there is a depth of about 1 foot; the deepest water follows the mainland shore the entire distance and owing to the fact that the depth is so small it is thought that there will be very little more filling if the channel follows the deepest water than there would be if some other location should be selected. Twenty-six and one-half miles from Corpus Christi an arm of the laguna known as Baffins Bay projects from the Laguna toward the west and on this bay is a small settlement known as Rivera. Twenty-five miles above Point Isabel the Arroyo Colorado enters the laguna; this stream projects into the irrigated land along the St. Louis, Brownsville & Mexico Railway. The material to be excavated is sand and silt with some soft rock, which is known as "laguna stone" and is consolidated shell sand. This rock is from 1 to 3 feet thick, lying close to the bottom of the laguna, and is sufficiently soft to be broken up and excavated by a suction dredge. The cost of excavation, however, will be increased by the difficulty of handling this material. The country bordering this section of waterway is very sparsely settled, with very little land under cultivation, and on account of lack of rainfall it would seem improbable that any very great development may, in the future, take place. The land is u

grazing purposes except at an occasional point where it is possible to graze a few head of cattle.

Estimated cost of dredging from Aransas Pass to Brazos Santiago.

Corpus Christi Cove: Prescribed 209,500 cubic yards, at \$0.15.....	\$31,425
From Corpus Christi Bay to Point Isabel: 17,356,400 cubic yards, at \$0.15.....	2,603,460
Total.....	2,634,885

Annual maintenance, \$100,000.

The country adjacent to this section of the canal is practically uninhabited from the shores of Corpus Christi Bay to Point Isabel. The country is used principally for grazing purposes and there is, at the present time, practically no produce seeking a market by a water route. Taking into consideration the immense cost of this section of the proposed canal in comparison with the possible benefits to be derived, the board does not consider that this section is worthy of improvement as proposed.

Brazos Santiago to the Rio Grande.—Brazos Santiago is the most northerly entrance from the Gulf into the protected waters within the sandy cordon that exists for very nearly the whole length of the coast of Texas. There is a natural depth through this pass of 9 feet. Opposite Brazos Santiago on the mainland is the small town of Isabel, which is connected by a narrow-gauge railroad with Brownsville, 25 miles distant, and in former days, before Brownsville was connected with the other railroads and Galveston Harbor by railroad, supplies and produce to and from Brownsville were handled by shallow-draft vessels through Brazos Santiago.

The line of the proposed channel extends from Isabel directly across the Laguna to the marshy peninsula between the Laguna and the Rio Grande and thence to the Rio Grande River. The depth of water in the Laguna between Isabel and the mainland averages about 3 feet; the height of this marshy land is perhaps 1 to 2 feet above mean low tide, and portions of it are at times flooded by salt water. The banks of the Rio Grande are considerably higher than the marshland between the Rio Grande and the Laguna, and while the river overflows its banks occasionally this does not occur very often near the mouth of the river. The surface of the river in times of flood, however, is often above the level of the marshland and a dam will be necessary where the channel connects with the Rio Grande River.

Estimated cost of dredging Brazos Santiago to the Rio Grande.

6,700 cubic yards, at \$0.15.....	\$271,005
Docks and auxiliaries at Rio Grande.....	155,000
Highway bridge.....	7,500
Contingencies, 10 per cent.....	43,350
Total.....	476,855

Maintenance annually, \$20,000.

This section of the canal passes through a portion of the Laguna Madre, thence across low marshy land to the bank of the Rio Grande. The adjacent country is at present uncultivated, being mainly marshland devoted to grazing purposes. Brownsville lies on the Rio Grande

River at approximately 60 miles from the mouth, and between Brownsville and the proposed entrance to the canal there is at the present time, even at low water, probably 9 feet or more. The country adjacent to Brownsville has developed during the past two or three years in a very wonderful manner. It has been found that by irrigation over 600,000 acres can be brought under cultivation. This land is extremely fertile, growing excellent sugar cane and other agricultural products suitable to the climate. An immense amount of money has been expended in clearing up this land, dredging irrigating canals, and in building pumping plants, sugar crushers and habitations, etc., all providing evidence that within a short time large quantities of agricultural products will be carried from the country adjacent to Brownsville for distribution. At the present time the only means of marketing the produce of this section is by a single line of railroad connecting Brownsville with Houston and Galveston, and the construction of the waterway would afford needed and material relief from high freight rates. Before the railroad entered the Brownsville territory all supplies and produce entered or found exit through Brazos Santiago, were lightered at Point Isabel, and carried by narrow-gauge railroad to Brownsville. This route has been abandoned since the entrance of the new railroad, as a result, it is claimed by the people of Brownsville, of the property being acquired by the new railroad. The people of the district are very anxious that some relief should be given them, and it would seem that a channel 9 feet deep and 100 feet wide from Point Isabel into the Rio Grande would be amply justified by the benefits to be derived. The board is therefore of the opinion that this section of the waterway is worthy of improvement to the full project dimensions, and recommends that the sum of \$476,855 be appropriated for the construction of such channel from Point Isabel into the Rio Grande River.

In making the above estimates the board has made no allowance for cost of right of way, with the exceptions of the portions between Lake Borgne and the Mississippi River and at the Rio Grande. It is believed that, in most instances, the advantage to the locality will be sufficient to cause communities interested in the movement and benefited thereby to furnish to the United States, without cost, the right of way required. Should it be necessary to construct a new line paralleling the Lake Borgne Canal, the benefit to adjacent property will be very small and, as the land is quite fertile and relatively valuable, it is doubtful if the right of way for this small stretch could be obtained without cost. Throughout the State of Louisiana the waterway will cross many rich and valuable plantations, but it is believed that the people are sufficiently awake to the value and importance of the waterway to provide a route without expense to the United States for acquisition of land. The board can not, however, too strongly urge that the authority of Congress for the construction of any section of the canal contain a provision authorizing the condemnation of right of way where the same can not be had by voluntary donation. Communities or commercial organizations which may desire to assist the Government and provide a right of way are without legal authority to secure the same from any landowner who may be unwilling to give or sell the tract needed, and it is evident that should any interest be hostile to the construction of a canal

asily defeat the purpose of the Government and the desire of community, if the War Department does not have authority to the land under due process of law.

estimates have been made in nearly all cases for excavation at a of 15 cents per cubic yard. This, for a very large portion of work, is regarded as liberal and no percentage is therefore included for contingencies, except in the short portion between Lake chartrain and the Mississippi, or Lake Borgne and the Mississippi, where the amount of dredging is slight compared with the work involved. At Pass Aux Herons the price was placed cents on account of the comparatively small amount of work, exposed locality, and the existence of oyster-shell reefs.

With regard to maintenance, the board believes that the waterway be kept in good condition more advantageously and economically government dredges than otherwise. The estimates have been based on the supposition that the work of construction will be done on contract.

The board does not consider the construction of the entire length of waterway as necessary, either for commercial, military, or naval purposes. With the exception of Louisiana and a small portion of Texas, the waterway does not have any considerable population adjacent to it, nor are there towns or other communities which it traverses. Its value in the cases where it has been recommended mainly as a connecting link between waterways running farther to the interior, enabling produce to be brought to the seaports more cheaply than at present and creating facilities for a more economical distribution of merchandise in return. In Louisiana the results will be secured, and also that of serving the community in the immediate vicinity of the canal. Although the canal is shown in Louisiana as traversing large extents of marsh and swamp land, the routes, as projected, pass through or lie along the southern border of the extensive sugar cane and rice district. In many cases the land traversed by the canal is marshy or swampy, due to its extreme flatness, which prevents drainage. With the reclamation and drainage of large areas along the route, it is believed that cultivation will be carried practically to the banks of the canal in a large proportion of the localities where it does not now exist.

Attention is again invited to the statement made in one or two places in the body of the report to the effect that the routes specified are believed to be the best judging from the information that has been obtainable to this time. The board wishes, however, to have these recommendations so regarded, and believes it inadvisable to have them taken as hard and fast lines which can not be changed or modified. Complications may arise concerning the right of way along one line which may be avoided by another, and where the right of way is to be provided free of cost it is inadvisable to have the executive department tied to a single line which may be blocked by a stubborn individual or hostile interests. East of the Mississippi River and west of the Sabine the lines upon which the waterway should be located are pretty well and, in many cases, absolutely defined by natural conditions. Between the Mississippi and the Sabine the character of the country is such that the route may be modified within limits without materially affecting either the length of the line or cost of construction, and the board believes that the

department should be free to adapt itself to conditions which prevail at the time the work is to be performed and not required to meet those which existed at the time this report was made, and which may have changed in the interval so as to impede the construction, increase the cost, or stop the work. Should the appropriations be made promptly, it believes the routes it has recommended will provide the most economical and advantageous lines.

LANSING H. BEACH,
Lieut. Col., Corps of Engineers.

H. JERVEY,
Maj., Corps of Engineers.

JOHN C. OAKES,
Capt., Corps of Engineers.

H. B. FERGUSON,
Capt., Corps of Engineers.

A. E. WALDRON,
Capt., Corps of Engineers.

The CHIEF OF ENGINEERS, UNITED STATES ARMY.

[For report of the Board of Engineers for Rivers and Harbors, see p. 11.]

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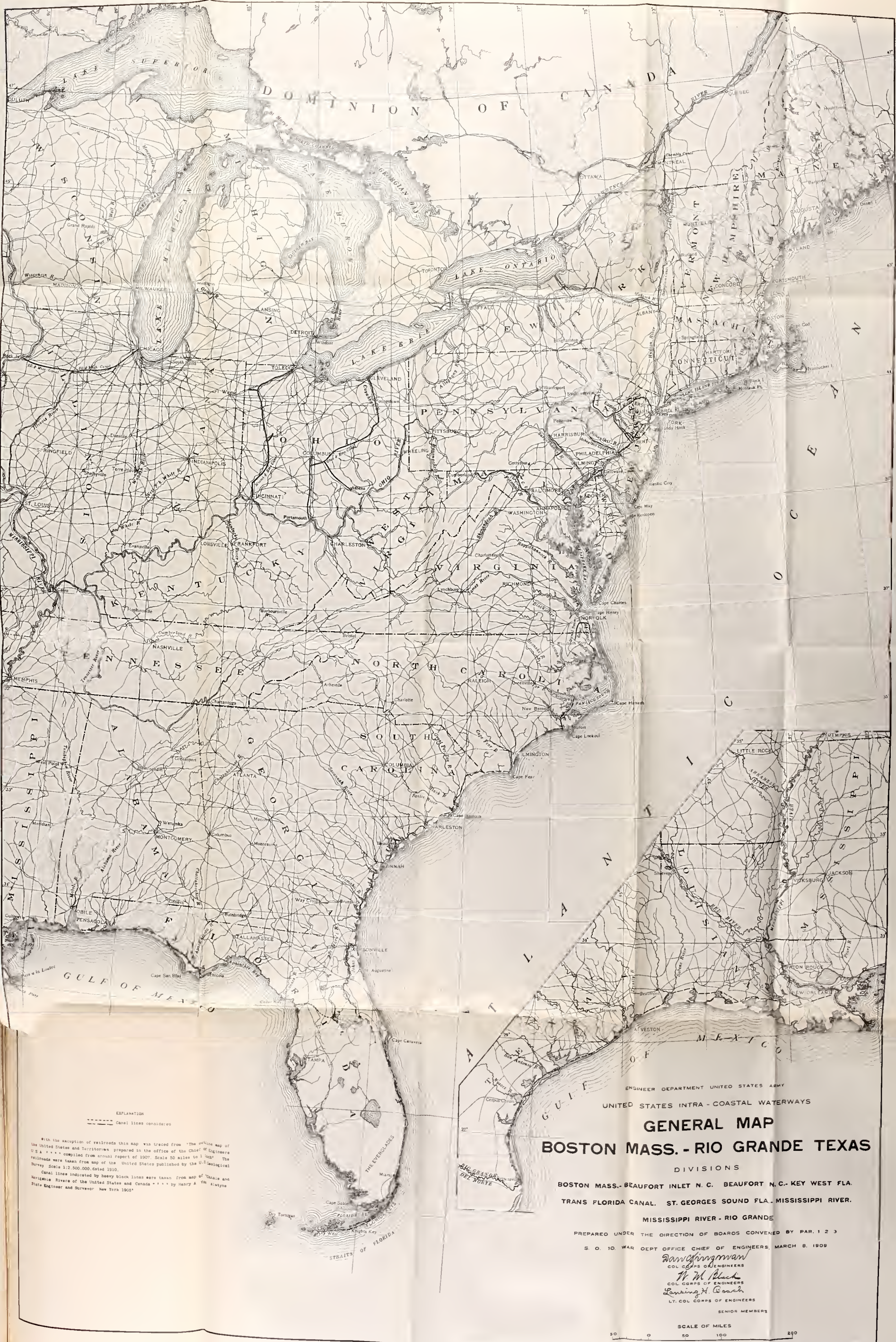
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EXPLANATION
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With the exception of railroads this map was traced from the official map of the United States and Territories prepared in the office of the Chief of Engineers U.S.A. compiled from annual reports of 1907. Scale 50 miles to 1 inch. The railroads were taken from map of the United States published by the U.S. Geological Survey. Scale 1:2,500,000, dated 1910.
Canal lines indicated by heavy black lines were taken from map of Texas and Navigation Rivers of the United States and Canada by Henry A. V. Alstyne State Engineer and Surveyor New York 1905.

ENGINEER DEPARTMENT UNITED STATES ARMY
UNITED STATES INTRA-COASTAL WATERWAYS

GENERAL MAP BOSTON MASS. - RIO GRANDE TEXAS

DIVISIONS

BOSTON MASS. - BEAUFORT INLET N.C. BEAUFORT N.C. - KEY WEST FLA.
TRANS FLORIDA CANAL. ST. GEORGES SOUND FLA. - MISSISSIPPI RIVER.
MISSISSIPPI RIVER - RIO GRANDE

PREPARED UNDER THE DIRECTION OF BOARDS CONVENED BY PAR. 123
S. O. 10. WAR DEPT OFFICE CHIEF OF ENGINEERS, MARCH 8, 1909

Barney G. Ingman
COL CORPS OF ENGINEERS
W. M. Black
COL CORPS OF ENGINEERS
Lanning H. Beach
LT. COL CORPS OF ENGINEERS

SENIOR MEMBERS

SCALE OF MILES

0 50 100 200

